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TM 5-4320-220-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, FIELD
AND DEPOT MAINTENANCE MANUAL

PUMP, CENTRIFUGAL:

GASOLINE DRIVEN; BASE MTD; 2 IN.; 166 GPM, 25 FT HEAD (BARNES MODEL 10-MG) SERIAL NUMBER 1 THROUGH 207, FSN 4320-820-0700

SAFETY PRECAUTIONS

BEFORE OPERATION

Be sure the centrifugal pump has proper exhaust connection to the outside before operation in an enclosed area. Exhaust gases contain carbon monoxide, which is a colorless, odorless, and poisonous gas.

When filling the fuel tank, always provide a metal-to-metal contact between the fuel container and the fuel tank. This contact will prevent a spark from being generated as gasoline flows over the metallic surfaces.

Be extremely careful when using a carbon tetrachloride type fire extinguisher in an enclosed area. A poisonous gas is generated by the contact of carbon tetrachloride with a heated metallic surface. Provide adequate ventilation before entering an enclosed area where carbon tetrachloride is used.

DURING OPERATION

Do not remove guards, shields, or screens to perform services or maintenance work while the unit is operating.

Do not fill the fuel tank while the unit is in operation. Gasoline spilled on a hot engine may explode and cause serious injury to personnel.

Be extremely careful when using a carbon tetrachloride fire extinguisher in an enclosed area. A poisonous gas is generated by the contact of carbon tetrachloride with a heated metallic surface. Provide adequate ventilation before entering an enclosed area where carbon tetrachloride is used.

AFTER OPERATION

Make sure the spark plug is disconnected before doing any work on the centrifugal pump.

When filling the fuel tank, always provide a metal-to-metal contact between the fuel container and the fuel tank. This contact will prevent a spark from being generated as gasoline flows over the metallic surfaces.

Be extremely careful when using a carbon tetrachloride type fire extinguisher in an enclosed area. A poisonous gas is generated by the contact of carbon tetrachloride with a heated metallic surface. Provide adequate ventilation before entering an enclosed area where carbon tetrachloride is used.

TECHNICAL MANUAL
No. 5-4320-220-15

HEADQUARTERS, DEPARTMENT OF THE ARMY WASHINGTON 25, D.C., 10 July 1961

Operator, Organizational, Field and Depot Maintenance Manual

PUMP, CENTRIFUGAL: GASOLINE DRIVEN; BASE; MTD; 2 IN.; 166 GPM, 25 FT HEAD (BARNES MODEL 10–MG) SERIAL NUMBER 1 THROUGH 207, FSN 4320–820–0700

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CHAPTER 1 INTRODUCTION

Section I. GENERAL

1. Scope

- a. These instructions are published for the use of personnel to whom the Barnes Centrifugal pump, Model 10-MG, is issued. Chapters 1 through 5 provide information on the operation, lubrication, daily preventive maintenance service, and organizational maintenance of the equipment, accessories, components, and attachments. Chapter 6 provides information for field and depot maintenance of the equipment. This manual also provides a description of main units and their function in relationship to other components.
- b. Appendix I contains a list of publications applicable to this manual. Appendix II contains the Maintenance Allocation Chart. Appendix III contains a list of the basic issue items authorized for use of the operator of this equipment. The Organizational, Field, and Depot Maintenance Repair Parts and Special Tool Lists are in TM 5-4320-220-25P.

- c. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.
- d. Report all deficiencies in this manual on DA Form 2028. Submit recommendations for changes, additions, or deletions to the Commanding General, Military Construction Supply Agency/U.S. Army Engineer Maintenance Center, Corps of Engineers, ATTN: EMCM, P.O. Box 119, Columbus 16, Ohio. Direct communication is authorized.

2. Operator and Organizational Maintenance Record and Report Forms

- a. Da Form 2258 (Depreservation Guide of Engineer Equipment).
- b. For other record and report forms applicable to the first and second echelons of maintenance, refer to TM 5-505, Maintenance of Engineer Equipment.

Section II. DESCRIPTION AND DATA

3. Description

a. General. The Barnes Centrifugal Pump, Model 10-MG (figs. 1 and 2), mounted on two base rails (fig. 2), is a portable, self-contained unit. It is powered by a one-cylinder gasoline engine (fig. 1) that is directly coupled to the pump (fig. 2) with all controls and indicators necessary for normal operation.

b. Engine. The Wisconsin Engine, Model MAENLD (fig. 1), which powers the centrifugal pump, is an air-cooled, single-cylinder, 4-cycle gasoline engine developing 6.1 hp (horsepower) at 3,600 rpm (revolutions per minute). Fuel is furnished by a float-type carburetor bolted to the cylinder crankcase. Ignition is furnished by a magneto with an impulse coupling to supply a powerful spark

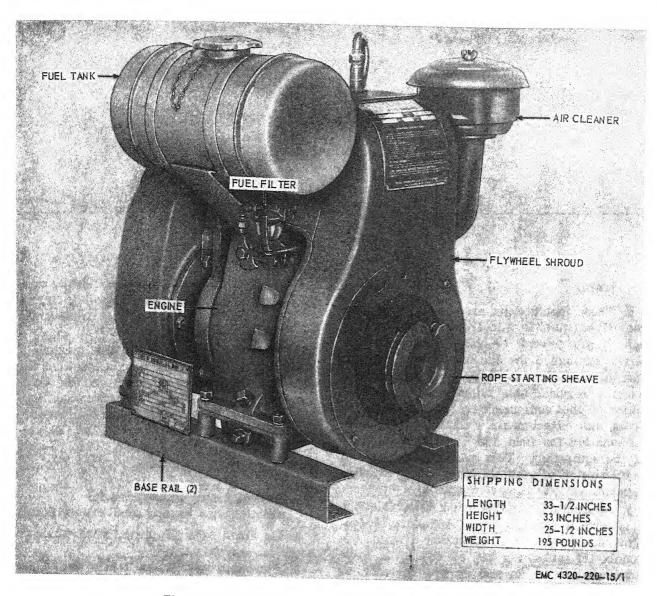


Figure 1. Centrifugal pump, right front three-quarter view.

for easy starting. Exhaust gases are piped to the outside of the unit through a muffler (fig. 1). A flow of air is forced to circulate through the flywheel shroud and around the cylinder crankcase fins to cool the engine.

c. Centrifugal Pump. The Barnes Centrifugal Pump, Model 10-MG, is a 2-inch water pump rated at 166 gpm (gallons per minute) at 25 foot-head. It is directly coupled to the engine (fig. 1).

4. Identification

The centrifugal pump has two identification plates. The Corps of Engineers Plate is located on the base rail on the right side of the unit and the engine plate is located on the air shroud covering the flywheel. The data on these plates are contained in tabulated data (par. 6).

5. Differences in Models

This manual covers only the Barnes Manufacturing Company Centrifugal Pump, Model 10-MG, serial numbers 1 through 207. No known unit differences exist for the model covered in this manual.

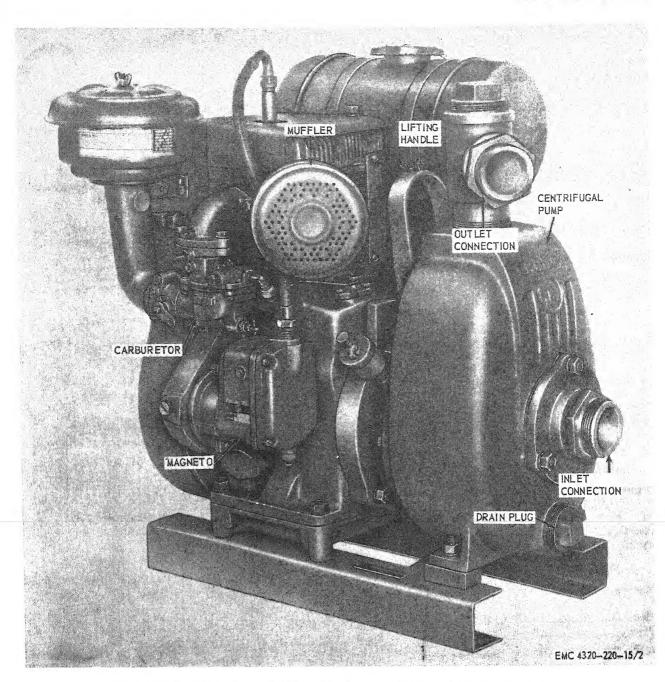


Figure 2. Centrifugal pump, left rear three-quarter view, with shipping dimensions.

6. Operator and Organizational Maintenance Tabulated Data

a. General.

Manufacturer	Barnes Manufacturing Com-
	pany
Model	10–MG
Туре	Portable, gasoline-driven
Nomenclature	Pump, centrifugal, water,
	166 gpm

b. Engine.

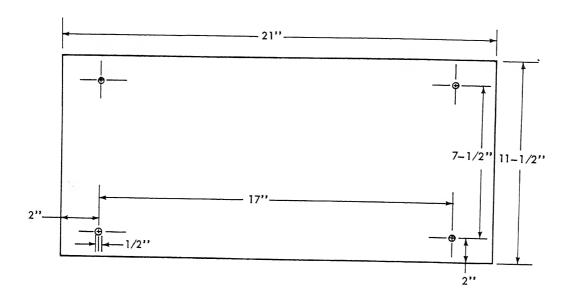
Manufacturer	Wisconsin Motor Corpora-
Model	MAENLD
Туре	L-head air-cooled
Number of cylinders	1
Cycle	_4
Cylinder	_3 in. (inch)
Ignition	Magneto

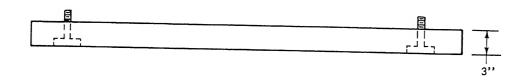
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Cranking method	Rope starting sheave		
Stroke	3 1/4 in	i. Engine Air Clean	er.
Cooling	Forced air	Manufacturer	United Specialties Corpora-
Horsepower	6.1 at 3.600 rpm		tion
Rated governed speed w	ith	Model	T_12_R1
load	2.625 rnm	Туре	Oil bath
Piston displacement	23 cu in. (cubic inch)	j. Magneto.	
c. Corps of Engin	neers Identification Plate.	Manufacturer	- Fairbanks Morse Company
Nomenclature	Pump, centrifugal, power	Type Drive	FM_XDE 1B7A Gear
Stools would	driven	k. Spark Plug.	
Stock number	4320-820-0700		Champion Manufacturing
make	Barnes Manufacturing Com-		Champion Manufacturing
Model	pany	Model	Corporation
Model Serial number	10_MG	Type	AED-16
Date manufactured		Size	04 K:
Contract must be		7 4 7 1	-18 mm (millimeter)
	DA 33-181-ENG-239	l. Adjustment Data.	
d. Wisconsin Moto	or Corporation Identifica-	Spark plug gap	0.030 in.
$tion\ Plate.$	•	Magneto breaker point ser	p-
Manufacturer	Wisconsin Motor Corpora-	aration	_0.015 in.
	4 i aa	Valve lifter (intake and ex	c-
Model	MAENI.D	haust	ain.
Serial number		Engine cold (intake)	0.008 in.
Size	3 x 3 1/4 in	Engine cold (exhaust)	_0.016 in.
Specification number	189294	m. Capacities.	
		Engine crankcase	1-1/2 qt (qart)
e. Centrifugal Pum	<i>p</i>	Engine air cleaner	3/16 at
Mandiacturer	Barnes Manufacturing Com-	Fuel tank	.1-1/2 gal (gallon)
Model	pany 10–MG	n. Maintenance and	l Operating Supplies.
f. Carburetor.		Table I provides a list	ting of all oils greage
Manufacturer	Zenith Carburetor Division	and gasonne required f	or the initial operation.
	Zenith Carburetor Division	o. Dimensions and We	eiaht.
	of Bendix Aviation Corporation	Length	
Model	68_7	Width	.00-1/2 in. 25 1/9 :
Туре	Undraft	Height	20-1/2 In.
	Opdiait	Weight	105 lb /man-3)
g. Fuel Strainer.			
Manufacturer	_Crippen Machine and Tool	installed on any suitable	entrifugal pump can be
		installed on any suitable	base, such as concrete,
Model	_830	wood, or steel. The ne	cessary dimensions for
Туре	_Standard	mstaning poits and posi-	itioning the centrifugal
h. Governor.		pump are snown in figur	e 3.
Manufacturer	_Wisconsin Motor Corpora-	q. Nut and Bolt Torqu	ie Data.
	tion	Engine cylinder head	
Model	_T-98_E	screws and nut	32 ft-lb (foot-pound)
Type	_Flyweight	Eligine intake manifold	9 ft-lb
	-	Engine spark plug	24 to 26 ft-lb

Table I. Maintenance and Operating Supplies

Notes	(1) Includes quantity of oil to fill engine oil system as follows: 1 1/2 qt crankcase 3/16 qt air cleaner (2) See SM 10-1-C4-1 for additional data and reqisitioning procedure. (3) See the current lubrication order for grade application and replenishment intervals. (4) Use oil as prescribed in item 1 above. (5) Tank capacity. (6) Average fuel consumption is 0.68 gal per hour of continuous operation.
Quantity required for initial operation	5 1/2 gal (6) As required
Quantity required for 8 hours	1 11/16 gt (3) 1 11/16 qt (3) 1 11/16 qt (3) 3/16 qt (3) (5). (6) As required As required
Description	ION OIL: us follows: 250 oil (2) 110 oil (2) ubzero (2) ITUE 5-gal can UTOMOTIVE CILLERY can
Federal stock no.	LUBRICATI 1 qt cans s 1 qt cans s 9150-265-9433 (2) OE30 or 9 9150-265-9425 (2) OE10 or 9 9150-242-7602 (2) OES oil Si LUBRICAT AUTOMO combat 91A 9150-190-0904 (2) GREASE A AND AR GAA 1-lb GAA 1-lb
Source four	10 10 10 10
Component application	0101 CRANK- CASE (1) (4) 0304 AIR (4) 0306 FUEL TANK 5500 PUMP
mətI	L 62 63 44





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Figure 3. Base plan.

CHAPTER 2 INSTALLATION AND OPERATION INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

7. Unloading Equipment

The centrifugal pump is shipped as a complete unit in a reinforced crate which holds the unit securely in a fixed position. A fork-lift truck, pipe rollers, or other handling equipment may be used to remove the unit from the carrier.

8. Unpacking Equipment

a. Place the centrifugal pump as near the point of installation as possible. Remove the nails holding the cover to the crate and remove the cover. Remove the inside end braces on both ends of the crate.

Note. Do not drive a crowbar into the crate. This may result in damage to the equipment.

- b. Lift the centrifugal pump clear of the crate by means of a sling or by manpower.
- c. Prepare equipment for inspection and operation as outlined on DA Form 2258, attached on or near the operational controls.

Inspection of New and Used Equipment

- a. Perform the preventive maintenance services (par. 32).
- b. Inspect the entire centrifugal pump for loss or damage which may have occurred during shipment.
- c. Inspect the fuel line, spark plug cable, and fittings to see that they are secure and free of breaks, kinks, and other damage.
- d. Inspect the engine accessories for damage and insecure mountings.
- e. With the ignition cable disconnected, manually turn the engine starting sheave to

insure free movement of the crankshaft, connecting rod, piston, and bearings.

f. Tighten loose fittings, bolts, nuts, or screws and replace missing parts.

10. Installation or Setting-Up Instructions

- a. This centrifugal pump is a portable unit designed to operate satisfactorily on any level surface. Locate the unit as near as possible to the source of supply, It may be installed indoors or outdoors, fith temporary or permanent mounting. Position the unit on any reasonable level surface and bolt it to a stable wooden or concrete base.
- b. Ample space must be provided on all sides of the centrifugal pump to afford adequate ventilation and working area for starting and servicing the unit.
- c. Connect suitable hoses to the suction and discharge flange adapters.
- d. The suction and discharge line diameters should never be less than the diameter of their respective pump connections. They should possibly be one or two sizes larger, based on friction loss incurred, due to pipe and fittings in the lines. The suction and discharge lines should be supported securely when attached to the pump.

11. Servicing New and Used Equipment

- a. Servicing. Service the centrifugal pump as directed in paragraph 30.
- b. Lubrication. Lubricate the centrifugal pump as specified in the current lubrication order.

c. Fuel System. Refer to Table I and fill the gasoline tank with the proper grade of gasoline and inspect for leaks.

Warning: When filling the fuel tank, always provide a metal-to-metal contact between the fuel container and fuel tank. This contact will prevent a spark from being generated as gaso-

line flows over the metallic surfaces.

Warning: Be sure that centrifugal pump has a proper exhaust connection to the outside before operation in an enclosed area. Exhaust gases contain carbon monoxide, which is a colorless odoress, and poisonous gas.

Section II. MOVEMENT TO A NEW WORKSITE

12. Dismantling for Movement

- a. Disconnect the hoses from the suction and discharge flange adapters.
- b. Cover the suction and discharge flange adapters to protect the threads and to prevent foreign material from entering the pump.
- c. Disconnect the outside exhaust piping if used.

13. Reinstallation After Movement to a New Worksite

For reinstallation of the centrifugal pump after movement to a new worksite, refer to paragraph 10.

Section III. CONTROLS AND OPERATION UNDER USUAL CONDITIONS

14. Controls

The purpose and positions of all controls will be found in figure 4.

15. Operation Under Usual Conditions

The operator must know how to operate the centrifugal pump. Paragraphs 16 through 18 contain instructions on engine starting, engine stopping, and the operating details of the centrifugal pump.

16. Engine Starting Instructions

- a. Preparation for Starting.
 - (1) Perform the before-operation services (par. 30).
 - Prime the pump as described in figure
 if the pump body is not full of water.

b. Starting. Start the engine as shown by figure 6.

Note: Allow engine to reach operating temperature before starting pumping operations.

Caution: Do not operate the pump for long periods without water running through it. Running the pump in a dry condition may damage the seal.

17. Engine Stopping Instructions

Stop the engine as shown by figure 7.

18. Operating Details

- α . Attach the suction and discharge lines to the appropriate flange adapters on the centrifugal pump (fig. 2).
 - b. Start the engine (par. 16).
- c. Proceed with the desired operation of the unit and perform the during-operation services (par. 30).

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

19. Operation in Extreme Cold (Below 0°F)

- a. General. Operation of the centrifugal pump under extreme cold conditions presents problems that demand special precautions and care in servicing the unit.
- b. Fuel System. In cold temperatures, condensation of moisture will cause water to accumulate in the fuel system. This water will

freeze and form ice crystals. Take the following precautions to prevent these crystals form clogging the fuel system:

(1) Remove the snow and ice from the fuel tank cap prior to filling the tank and keep the tank full at all times.

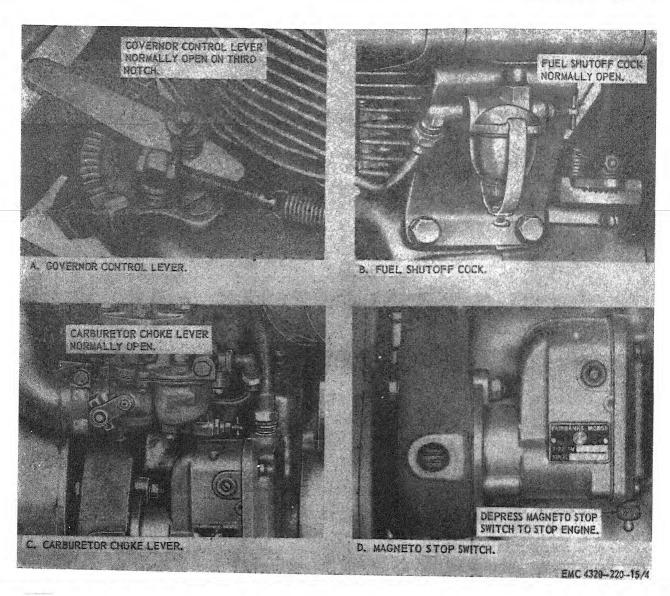


Figure 4. Controls.

- (2) Keep the fuel tank cap tight to prevent moisture and dirt from entering the tank.
- (3) Service the fuel strainer more frequently than during normal operation (par. 54).
- c. Ignition System. In cold weather, be sure the spark plug is kept clean and free from moisture. Remove ice and snow from the spark plug, magneto, and cable. See that the ignition connections are clean and tight. Since the insulation on the cable tends to become brittle at low temperatures, avoid excessive

handling and sharp bending.

- d. Lubrication.
 - (1) Lubricate the engine and pump in accordance with the cold weather instructions in the current lubrication order.
 - (2) Service the air cleaner more frequently than during normal operation (par. 59).
- c. Centrifugal Pump.
 - (1) To avoid freezing, drain the pump when the flow of water is halted.

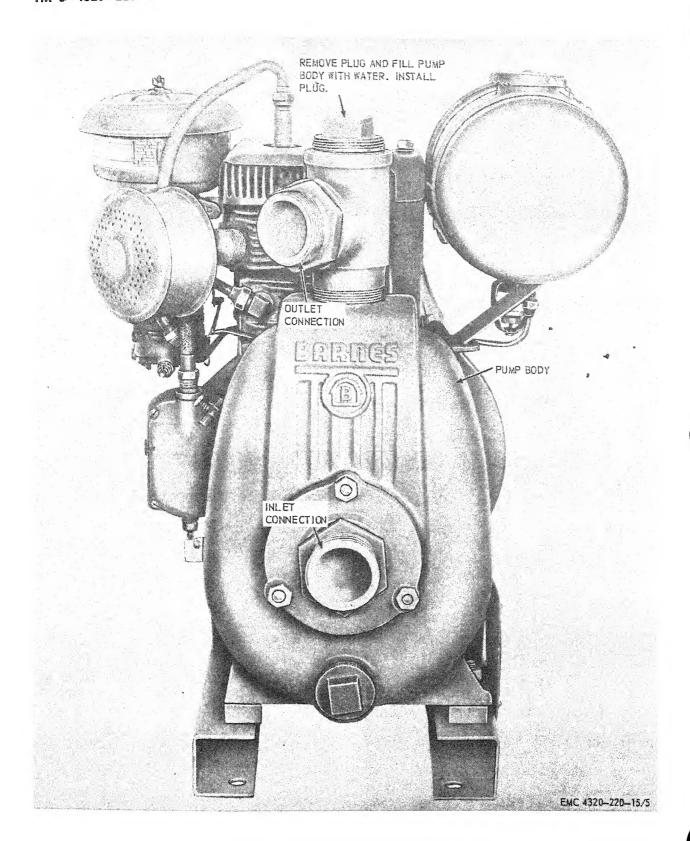
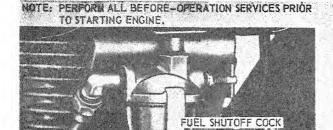
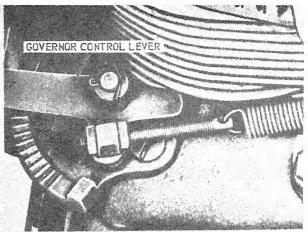


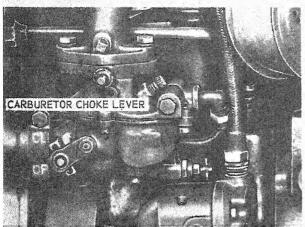
Figure 5. Pump priming instructions.



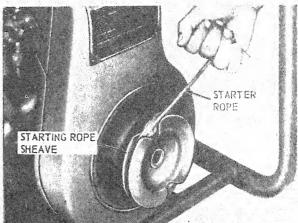
STEP 1. OPEN FUEL SHUTOFF COCK.



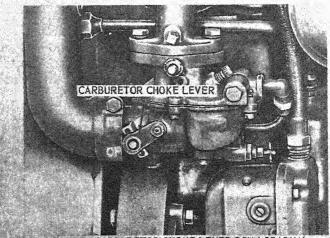
STEP 2. SET GOVERNOR CONTROL LEVER THREE NOTCHES BACK FROM MAXIMUM POSITION.



STEP 3. PUSH CARBURETOR CHOKE LEVER UP TO CLOSE CHOKE.



STEP 4. WRAP STARTER ROPE AROUND STARTING ROPE SHEAVE AND PULL.



STEP 5. PUSH CARBURETOR CHOKE LEVER DOWN GRADUAL-LY AS ENGINE WARMS UP.

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Figure 6. Engine starting instructions.

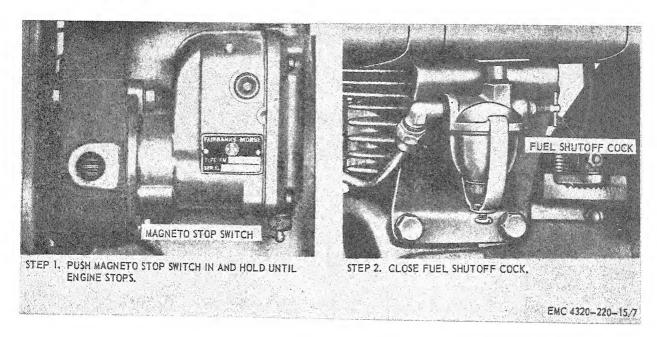


Figure 7. Engine stopping instructions.

(2) Before operation, prime the pump with warm water (par. 16).

Caution: Do not use boiling water in the pump housing in cold weather.

20. Operation in Extreme Heat

- a. General. Efficient cooling, adequate ventilation, and lubrication are of vital importance to the operation of the centrifugal pump in extreme heat.
- b. Cooling. Protect the unit from direct rays of the sun, if possible. Maintain adequate space around the unit to provide proper ventilation. If operated inside an enclosure, install a fan to provide air circulation, if possible. Inspect the flywheel shroud and screen and cylinder crankcase fins for insufficient ventilation of the engine in extreme heat. Clean the fins and screen at regular intervals.
- c. Lubrication. Lubricate the centrifugal pump in accordance with the current lubrication order for hot weather operation. Maintain the oil at proper level in the engine crankcase.

21. Operation in Dusty or Sandy Areas

a. Protection. Shield the unit from sand and dust. Take advantage of natural barriers

which offer protection from blowing sand or dust, or erect a suitable shield if possible.

b. Cleaning. Service the engine air cleaner frequently when operating the unit under dusty sandy conditions. Replace oil in the oil cup when it becomes dirty.

c. Fuel System.

- (1) Provide adequate protection to keep sand and dirt from entering the fuel tank when filling the tank.
- (2) Service the fuel strainer as often as necessary to keep it free of sand and dirt (par. 54).
- d. Cooling. Keep the flywheel shroud and screen and cylinder crankcase fins free from all dust, dirt, and other material that might prevent proper engine cooling.

e. Lubrication.

- (1) Lubricate in accordance with the current lubrication order. Keep lubricants free of dust and sand. Keep lubrication points and lubrication equipment clean. Avoid excessive lubrication, as dust and sand will adhere to lubricants and work into lubrication areas.
- (2) Service the air cleaner more frequently than during normal operation (par. 28).

Operation Under Rainy or Humid Conditions

- a. General. When the unit is not operating, place a canvas or other waterproof cover over the unit. During humid periods, dry the unit before operating. Keep the fuel tank full to avoid condensation.
- b. Ignition System. The spark plug, magneto, and cable often become unserviceable because of high humidity. Affected parts should be removed and dried. If this does not remedy the condition, they must be replaced.

23. Operation in Salt Water Areas

a. General. Salt water creates a strong corrosive action on metal. Care must be taken to avoid direct contact with salt water. Wash down the entire unit with clean, fresh water at frequent intervals. Take care not to contaminate the fuel system or damage the ignition system with the water.

- b. Protection Against Corrosion. Coat exposed metal surfaces with rustproofing material to keep moisture from causing rust. Remove any rust immediately and cover the exposed surfaces with a coat of paint. Refer to TM 9-2851 and TB ENG 60 for painting instructions.
- c. Lubrication. See that the crankcase oil is not contaminated by salt water. Lubricate the unit in accordance with the current lubrication order.

24. Operation at High Altitudes

- a. The pump will operate at high altitudes without special adjustment or servicing.
- b. Make sure the air cleaner is clean and does not restrict the flow of air. Service the air cleaner frequently.
- c. At high altitues, it may be necessary to adjust the engine carburetor. Adjust the carburetor (par. 56).

Section V. OPERATION OF AUXILIARY MATERIAL USED IN CONJUNCTION WITH THE CENTRIFUGAL PUMP

Fire Extinguisher (Carbon Tetrachloride Type)

- a. Description. A carbon tetrachloride fire extinguisher may be provided with the equipment. It is a vaporizing, liquid-type, pump-operated extinguisher, having a capacity of 1 quart.
- b. Operation. Remove the fire extinguisher from its location; turn the handle and work the handle like that of a pump. Direct the stream at the base of the flame.

Warning: Be extremely careful when using a carbon tetrachloride fire extinguisher in an enclosed area. A poisonous gas is generated by the contact of carbon tetrachloride with a heated metallic surface. Provide adequate ventilation before entering an enclosed area where carbon tetrachloride has been used.

c. Refilling and Maintenance. For detailed information on refilling and maintenance, refer to TM 5-687 and TM 9-1799.

26. Fire Extinguisher (Monobromotrifluoromethane Type)

a. Description. The monobromotrifuoromethane type fire extinguisher replaces the

carbon dioxide and carbon tetrachloride type fire extinguishers used in the past. It is generally suitable for use on all types of fire, with the exception of fires involved with LOX (liquid oxygen) generating equipment. The fire extinguisher is furnished with a disposable type cylinder.

- b. Operation. To operate the fire extinguisher, perform the following operations:
 - (1) Remove the fire extinguisher from its location.
 - (2) Break the seal by pulling the safety pin from the handle.
 - (3) Point the horn at the base of the flame.
 - (4) Depress the trigger for discharge and direct the stream of contents at the base of the fire.
 - (5) Replace with a new cylinder immediately after using.
- c. Replacement of Cylinder. To replace with a new cylinder, perform the following operations:
 - (1) Press the lever to release the pressure from the old cylinder.

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- (2) Loosen the swivel valve coupling nut and remove the valve assembly from the used cylinder.
- (3) Remove the instruction band from the used cylinder.
- (4) Place a new cylinder through the instruction band.
- (5) Replace the safety pin in the valve and the seal pin with sealing wire.
- (6) Attach the valve assembly and tighten the swivel coupling nut on the new

- cylinder and replace the fire extinguisher in mounting bracket.
- (7) Adjust the instruction band on the cylinder to show maintenance and operating instructions.
- d. Maintenance. Weigh fire extinguisher every 6 months and replace cylinder if gross weight has decreased 4 ounces or more. Lubricate cylinder neck threads with 1 drop of OE 30 oil before reassembly.

CHAPTER 3 OPERATOR AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Note. No special tools or equipment are required to perfom maintenance on the operator or organizational maintenance personnel.

Section I. LUBRICATION

27. General Lubrication Information

- a. This section contains a reproduction of the lubrication order (LO) and lubrication instructions, which are supplemental to and not specifically covered in, the lubrication order
- b. The lubrication order shown in figure 8 is an exact reproduction of the approved lubrication order for the centrifugal pump. For the current lubrication order, refer to DA Pam 310-4.

28. Detailed Lubrication Information

a. Care of Lubricants. Keep all lubricants (grease and oil) in closed containers and store in a clean, dry place away from heat. Allow no dirt, dust, water, or foreign material to mix with the lubricant at any time. Keep all lubrication equipment clean and ready for use.

- b. Points of Application. Follow the detailed lubrication instructions given beneath each lubrication point illustration specified on the current lubrication order.
- c. Cleaning. Keep all external parts not requiring lubrication clean from lubricants. After every lubrication operation, remove any excess lubricant from the point of application and wipe away any spilled lubricant. Old or hardened lubricants may be removed by using an approved cleaning solvent.
- d. Operation After Lubrication. Operate the unit for 5 minutes after lubrication to work the clean oil into bearing surfaces. Stop the unit and check the oil level. Add oil to bring the oil level up to FULL mark, if necessary.
- e. Engine Air Cleaner Servicing. Refer to figure 9 and remove the engine air cleaner.

LUBRICATION

ORDER LU

LO 5-4320-220-15

PUMP, CENTRIFUGAL: GASOLINE DRIVEN; BASE MTD; 2 IN; 166 GPM, 25 FT HEAD, (BARNES MODEL 10-MG) W/WISCONSIN ENGINE MODEL MAENLD

Reference: SM 10-1-C4-1

Intervals are based on normal operation. Reduce to compensate for abnormal operations and severe conditions. During inactive periods sufficient lubrication must be performed for adequate preservation.

Clean fittings before lubricating.

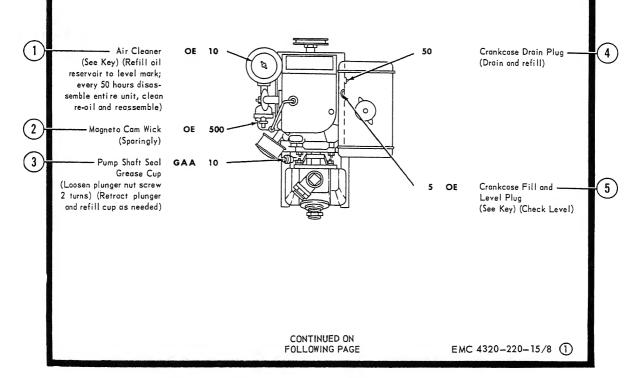
Relubricate after washing.

Clean parts with SOLVENT, dry-cleaning; or with OIL, fuel, Diesel. Dry before lubricating.

Drain crankcase only when hot after operation; replenish and check level when cool.

LUBRICANT . INTERVAL

INTERVAL . LUBRICANT



1 Front Figure 8. Lubrication order—LO 5-4320-220-15.

CONTINUED FROM PRECEDING PAGE - KEY -

		EXPECTED TEMPERATURES			INTERVALS	
LUBRICANTS	CAPACITY	Above +32°F +40°F to -10°F		0°F to -65°F	INTERVALS	
OE-OIL, Engine, Heavy Duty					Intervals	
Crankcase	1-1/2 qt	OE 30 or 9250	OE 10 or 9110	OES	given are	
Air Cleaner	3/16 qt				in hours of	
Oil Can Points		9250	9110		normal	
OES -OIL, Engine Subzero					operation.	
GAA-GREASE, Automotive and Artillery			All Temperatures		- F	

NOTES:

1. FOR OPERATION OF EQUIPMENT IN PROTRACTED COLD TEMPERATURES BELOW -10°F. Remove lubricants prescribed in the key for temperatures above -10°F. Clean parts with SOLVENT, dry-cleaning. Relubricate with lubricants specified in the key for temperatures below

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory.

BY ORDER OF THE SECRETARY OF THE ARMY:

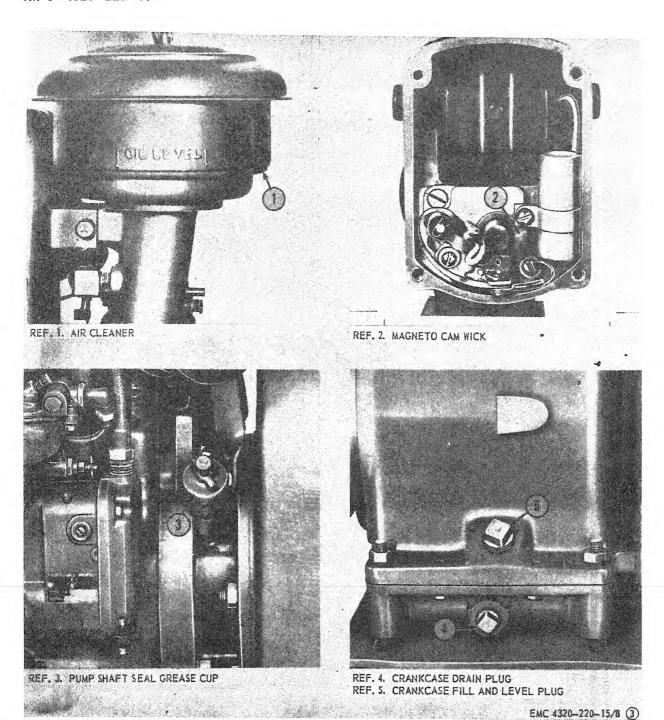
G. H. DECKER, General, United States Army, Chief of Staff.

2. OIL CAN POINTS. Every 50 hours clean and lightly coat the governor and carburetor linkage with OE.

OFFICIAL: R. V. LEE, Major General, United States Army, The Adjutant General.

EMC 4320-220-15/8 2

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3 References 1 through 5 Figure 8 —Continued.



Figure 9. Engine air cleaner, servicing.

Section II. PREVENTIVE MAINTENANCE SERVICES

29. Operator's Maintenance

To insure that the equipment is ready for operation at all times, it must be inspected systematically before operation, during operation, and after operation, so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance services will be performed before operation. Defects discovered during operation of the unit wll be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noticed during operation which would damage the equipment if operation were continued. After-operation services will be performed at intervals based

on the normal operations of the equipment. Reduce interval to compensate for abnormal conditions. Defects or unsatisfactory operating characteristics beyond the scope of the operator to correct must be reported to organizational maintenance at the earliest opportunity. Responsibility for performance of preventive maintenance services rests not only with the operator but also with the entire chain of command from section chief to commanding officer (AR 750-5).

30. Operator's Daily Services

a. General. The intervals at which the operator's daily services are to be performed are indicated by an x, in the appropriate column,

on the small tab located at the bottom of each illustration in figure 10. The tab columns are B (before), D (during), and A (after) operation of the equipment. The intervals and services not illustrated are prescribed in b through d below.

- b. Before-operation Services.
 - (1) Visual inspection. Make a visual inspection of the centrifugal pump for cracks, breaks, and loose or missing bolts and nuts. Inspect to see whether the centrifugal pump has been tampered with or damaged. Look for evidence of fuel or oil leaks underneath the engine. Inspect to see whether the centrifugal pump is as level as possible. Correct all deficiencies noticed or report the condition immediately to organizational maintenance.
 - (2) Publications. See that a copy of this manual, the current lubrication order, and DA Form 285 are on or with the centrifugal pump and in serviceable condition.
 - (3), Lubrication. Determine whether lubrication services have been performed since the last operation of the centrifugal pump. Lubricate as required in accordance with the current lubrication order and as instructed in paragraph 28.
- c. During-operation Services.
 - (1) Visual inspection. Observe the centrifugal pump while in operation for leaks. Make sure the unit remains stationary and as level as possible. Shut down the operation and correct or report deficient conditions to organizational maintenance. Do not resume operation until the deficient conditions have been corrected.
 - (2) Unusual operation and noises. Observe the centrifugal pump while in operation for loose mountings, excessive vibrations, unusual noises, overheating, smoking, and erratic pump intake or discharge. If any of these noises or irregularities are noticed, shut down the operation at once and

correct or report the condition to organizational maintenance. Do not resume operation until the condition has been corrected.

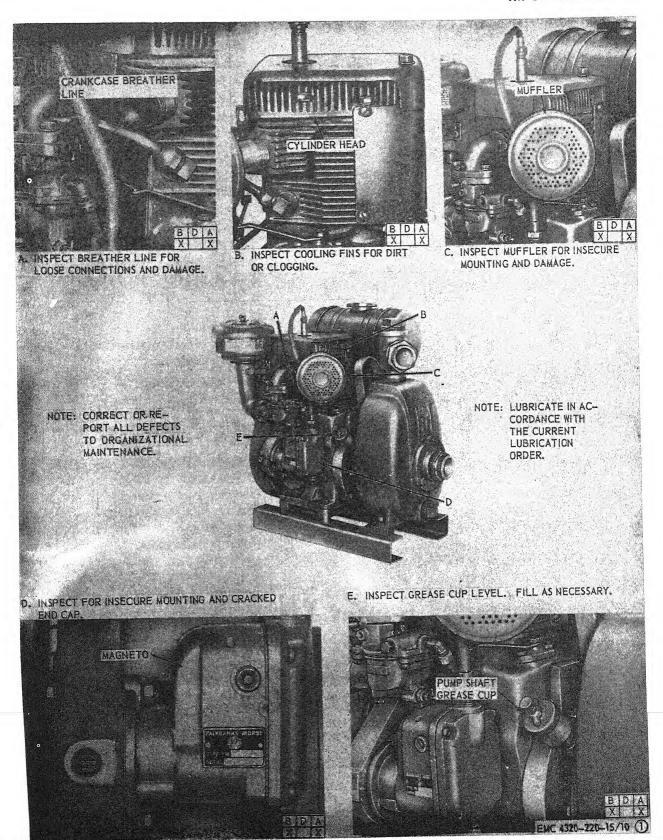
d. After-operation Services.

- (1) Engine. Inspect the fuel tank and replenish the fuel supply. Check the oil level in the crankcase and add oil if necessary, in accordance with the current lubrication order.
- (2) Lubrication. Lubricate as required in accordance with the current lubrication order and as instructed in paragraph 28.
- (3) Visual inspection. Make a complete visual inspection of the centrifugal pump for cracks, breaks, and loose or missing bolts and nuts. Inspect the fuel line for leaks. Correct or report these conditions to organizational maintenance.
- (4). Cleaning. Clean all dirt, grease, sludge, and oil from the centrifugal pump with an approved cleaning solvent and wipe dry
- (5) Protection. Protect the centrifugal pump from damage, tampering, and the elements by covering it with a canvas cover or placing it in a sheltered place. When the centrifugal pump is inactive for any length of time, unpainted parts should be covered with an approved rust preventive compound.

31. Organizational Maintenance

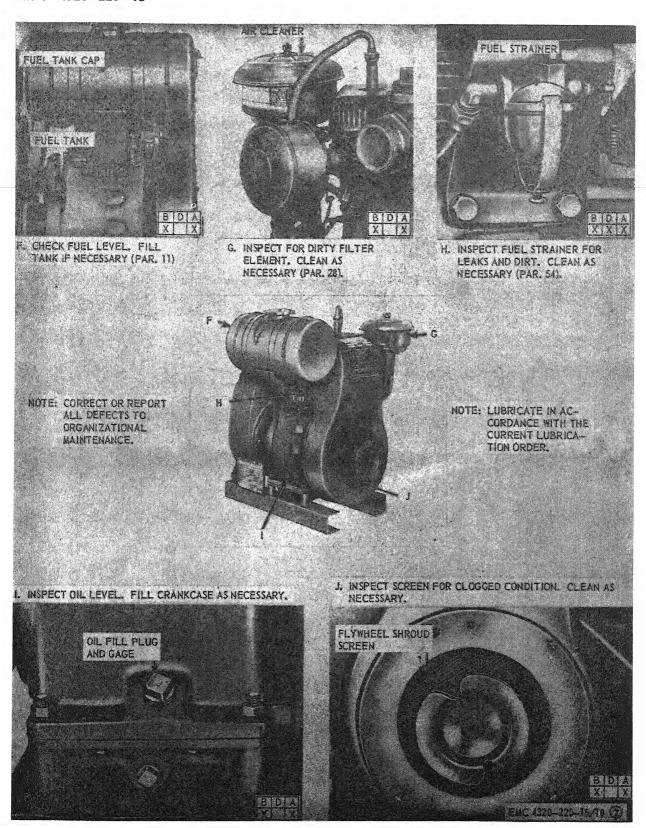
- a. Preventive maintenance is performed by organizational maintenance personnel at quarterly intervals. A quarterly interval is equivalent to 3 calendar months or 250 hours of operation, whichever occurs first.
- b. The Preventive Maintenance Services to be performed at quarterly intervals are listed consecutively (starting with number 1) and are described in paragraph 26. The number opposite each service refers to a Preventive Maintenance Service "Title" on DA Form 464 and indicates the services to be performed. The number listed under "Inspection"





(1) References A through E. Figure 10. Operator's daily services.

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(2) References F through J. Figure 10—Continued.

GENERAL



indicates the minimum inspection requirements for the equipment.

Quarterly Preventive Maintenance

32.	Qu	arterly Preventive Maintenance			
	Ser	vices		8	Tighten loose cylinder head bolts or replace
Inspection	Service quarterly	GENERAL	9	9	the gasket (par. 66). Replace a defective exhaust muffler and pipe (par. 49). Replace a defective intake manifold and gasket (par. 57). Valve Mechanism. Inspect the valve in-
		D. C. C. Bowless Bowform the			spection cover plate and gasket for oil
1 2	1 2	Before-Operation Services. Perform the daily services listed in paragraph 30. Lubrication. Inspect the centrifugal pump			leaks. If excessive valve lifter noise or loss of power is noticed, measure the
ند		for indications of insufficient lubrica- tion. Inspect for a damaged drain plug or grease cup.		9	valve lifters for proper clearance. Replace a leaking valve inspection cover plate or gasket (par. 67). Adjust the valve lifter clearance if necessary (par.
	2	Lubricate the equipment in accordance with paragraphs 27 and 28. Replace a			67.)
		damage drain plug (par. 55). Replace a damaged grease cup (par. 70).	10	10	Compression Test. Remove the spark plug and insert a compression gage in the cylinder head. Crank the engine
3	3	Tools and Equipment. Inspect the condition of all tools and equipment assigned to the centrifugal pump.			with the starting rope and note gage reading. The gage reading should be 85 to 95 psi (pounds per square inch). A
	3	See that all tools and equipment assigned to the centrifugal pump are clean and serviceable.			compression test reading of less than 85 psi indicates faulty valves, pistons, piston rings, or cylinder head geasket.
4	4	Fire Extinguishers. Inspect the carbon tetrachloride type fire extinguisher every 4 months for improper charge and damage. Refer to TM 5-687 and TM 9-1799. Weigh a monobromotrifluoromethane type fire extinguisher every 6 months and replace the cylinder is the gross weight has decreased 4 ounces or more. Lubricate neck with 1 drop of OE 30 oil before reassembly. Replace a defective fire extinguisher.		10	Determine whether the cylinder head gas- ket, piston, or piston rings are faulty by pouring 1 fluid ounce of an approved crankcase lubricant into the cylinder chamber and repeat the test This com- pression test reading should be higher than before adding the lubricant to the cylinder chamber. If low compression is still evident, the valves are defective. Report the condition to field main-
5	5	Publications. See that a copy of this manual, the current lubrication order, and DA Form 285 are on or with the equipment and in serviceable condition.	11	11	tenance. Crankcase Breather Line. Inspect the crankcase breather line of leaks and loose fittings or any other damage. Tighten loose fittings or replace a damaged
6	6	Appearance. Inspect the general appearance of the centrifugal pump for dirt, illegibility of identification markings, and chipped or cracked paint. Correct all deficient conditions in appearance of the centrifugal pump.	12	12	breather line (par. 51). Flywheel and Shroud. Inspect the flywheel for cracks and broken vanes. Inspect the flywheel shroud for bends, cracks, loose mounting bolts, and improper alinement
7	7	Modifications. See that all available modification work orders apply to the centrifugal pump have been completed and recorded on DA Form 478, DA Form 5-73, or DA Form 5-73a, as applicable.	13	12	with the flywheel. Replace a defective flywheel (par. 65). Tighten loose bolts in the flywheel shroud. Repair or replace a damaged flywheel shroud (par. 50). Starting Sheave. Inspect the starting sheave for nicks, burs, cracks, breaks,
8	8	ENGINE Cylinder, Head, Manifold, Muffler, And Pipe. Inspect the cylinder head, intake manifold, exhaust muffler, and pipe for leaks, loose bolts, and defective gaskets.		13	and looseness.

Inspection

Service quarterly

				1
Inspection	Service quarterly	GENERAL	Inspection	Service quarterly
14	14	Governor and Linkage. Inspect the govern- or linkage for worn, damaged, or de- fective parts.		
	14	Replace any defective governor linkage and adjust the linkage (par. 58). Re- port any governor condition that cannot be corrected to field maintenance.		20
15	15	Carburetor and Linkage. Inspect the carburetor for leakage, damage, and loose mounting. Inspect the choke and governor carburetor linkage for binding and worn condition.	21	21
	15	Tighten a loose fuel line fitting and mounting hardware. Replace a defective carburetor if necessary (par. 56). Repair or replace worn or damaged linkage.		
16	16	Fuel Strainer. Inspect the fuel strainer for leakage, damage, and loose mounting. Inspect the glass bowl for evidence of sediment and water.		21
	16	Remove the glass bowl and dispose of any sediment and water. Tighten a loose fuel line fitting mounting hardware. Replace the gasket if necessary and repair or replace a defective fuel strainer (par. 54).		
17	17	Air Cleaner. Inspect the air cleaner for loose connections and mounting. Inspect the oil cup for presence of dirt and improper oil level. Inspect the air cleaner	22	22
	17	for dents, cracks, and other damage. Service the air cleaner as instructed in paragraph 28. Tighten all loose mount-	23	23
		ing hardware. Replace a defective air cleaner (par. 59).	24	23 24
18	18	Fuel Tank, Cap, and Gaskets. Inspect the fuel tank for leaks, other damage, and insecure mounting straps and bracket	24	
		Remove and inspect the fuel cap and gasket for evidence of damage. Make		24
		sure the gasket is in a serviceable condition.	25	25
	18	Replace a defective fuel tank cap, or gas-		25
		ket. Tighten fuel tank mounting straps and bracket if necessary. Replace a de-	26	26
19	19	fective fuel tank (par. 53). Fuel Lines. Inspect the fuel strainer-to- carburetor fuel line for cracks, breaks,		26
	19	kinks, and leakage. Tighten loose connections. Replace a defective fuel line (par. 54).	27	27
20	20	Spark Plug and Cable. Inspect the spark plug for cracked porcelain, burned electrodes, carbon deposits, and incorrect gap. The correct gap is 0.030 inch.		27

GENERAL

Use a suitable spark plug tester and test the spark plug for proper operation. Inspect the cable for damage and loose or corroded connections.

Clean and adjust the spark plug (par. 62). Replace a defective spark plug and cable (par 62). Tighten all loose connections.

Magneto. Inspect the magneto for cracks. breaks, and loose mounting. Inspect the spark plug cable connections for looseness and corrosion. Remove the end cap cover inspect the breaker points for wear, pitting, and improper separation (par. 61). The correct separation adjustment is 0.015 inch. Inspect the vent screen for cleanliness.

Tighten all loose mounting hardware and cable connections. Remove all dirt, grease, and corrosion. Clean and adjust the breaker points (par 61). Report a defective contact set to field maintenance. Remove and service the magne vent screen (par. 61). Replace a defective magneto (par. 61).

CENTRIFUGAL PUMP

Valves. Inspect the suction valve for leaks and improper operation. Repair a defective suction valve (par. 70).

Frame. Inspect the base rails for cracks, breaks, and other damage.

Replace defective base rails (par. 68).

Couplings. Inspect the coupling for cracks, breaks, loose mounting hardware, and misalinement.

Tighten all loose mounting hardware. Replace a defective coupling (par. 70).

Impeller. If the pump is noisy, inspect the impeller for looseness or damage.

Tighten if loose or replace a damaged impeller (par. 70).

Grease Seal. Inspect the grease seal for evidence of dryness or leakage.

Lubricate the grease seal in accordance with the current lubrication order. Replace a defective grease seal (par. 70).

Pump Housing. Inspect the pump body for cracks, breaks, misalinement, and loose or missing mounting hardware.

Tighten or replace all loose or missing mounting hardware. Replace a damageed pump body (par. 70).

Section III. OPERATOR AND ORGANIZATIONAL MAINTENANCE TROUBLESHOOTING

33. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the centrifugal pump and its components. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause. Any operational trouble that is beyond the scope of organizational maintenance must be reported to field maintenance, third echelon.

34. Engine Is Hard to Start or Fails to Start

Probable cause	Possible remedy
Fuel tank empty	Fill the fuel tank (par 11).
Fuel shutoff valve closed	Open the fuel shutoff valve.
Fuel mixture improper	Adjust the carburetor (par.
	56).
	Replenish the fuel supply
	with correct grade of fuel
	(Refer to Table I).
Fuel strainer clogged	Service the fuel strainer
	(par. 54).
Carburetor clogged	Clean or replace the carbu-
	retor (par. 56).
Cylinder flooded	-Close the high-speed adjust-
	ment valve, open the
	governor control, and
Smanly mlana dinter an	crank the engine until the
Spark plug dirty or	excess fuel is removed.
damaged	Clean, adjust, or replace the
Manuela baselan mainta en	spark plug (par. 62).
Magneto breaker points ou of adjustment or the con	
	- Adjust the breaker points
tact set defective	(par. 61). Report the de-
	fective contact set to field
	maintenance.
Marmete defective	Replace the magneto (par.
magneto defective	61).
Ignition cable defective	Replace the ignition cable
18 Intituit Cable defective	(par. 62).
Magneto out of timing	

35. Engine Misses or Runs Erratically

Probable cause	Possible remeay
Spark plug dirty or dam-	
aged	Clean, adjust, or replace the
- v	spark plug (par. 62).
Ignition cable loose or de-	
fective	Tighten or replace the igni-
	tion cable (par. 62).

Magneto breaker points out
of adjustment or the con-
tact set defective Adjust breaker points (par. 61). Report the defective contact set to field maintenance.
Valve lifter clearance in-
correctAdjust the valve lifter clearance (par. 67).
Carburetor out of adjust-
ment or defective Adjust or replace the car- huretor (par. 56).
Fuel strainer clogged Service the fuel strainer (par. 54).
Carburetor choke partially
closedOpen the choke fully. Air cleaner clogged or air
flow restricted Service the air cleaner (par.
28). Provide proper venti-
Governor linkage out of
adjustmentAdjust the governor linkage
(par. 58).
Fuel tank contains water Drain the fuel tank and replenish with the proper grade of fuel (par. 11). Service the fuel strainer (par 54).
24 Empire Vmade

36. Engine Knocks

$Probable\ cause$	Possible remedy
Fuel of poor grade	
	plenish with the proper
	grade of fuel (par. 11).
Crankcase oil lever low	Fill the crankcase to proper
	level.
Engine under heavy load at	
low speed	Open the governor control.
Ignition timing advanced	
	Retime the ignition (par.
	61).

37. Engine Exhaust Smoke Excessive

Probable cause	Possible remedy
Carburetor out of	
adjustment	Adjust, clean, or replace the
	carburetor (par. 56).
Fuel poor grade	Drain the fuel tank and re-
	plenish with the proper
	grade fuel (par. (11).
Air cleaner dirty	Service air cleaner (par.
	28).

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38. Engine Overheat	38.	Engine	Overheat
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Probable cause	Possible remedy
Crankcase oil lever low	Fill to proper level.
Fuel of poor grade	Drain the fuel tank and re-
	plenish with proper grade of fuel (par. 11).
Air flow restricted	Provide adequate ventilation. Clean the cooling
Floral as	fins
ruel mixture too lean	Adjust the carburetor (par.
	56).
Exhaust restricted	Remove and clean the muf-
	fler and pipe nipple (par.
	49).

39. Engine Backfires

$Probable\ cause$	Possible remedy
Fuel contains dirt or	•
	Drain the fuel tank and replenish with the proper grade of fuel (par. 11).
Fuel strainer clogged	Service the fuel strainer (par. 54).
	Adjust the carburetor (par. 56).
Timing incorrect	Reset the timing (par 61).
Intake valve sticking	Personal results and pour a small amount of preservative oil into the engine block to loosen the valve
Spark plug too hot	Install the spark plug with correct heat range (par. 62).

40. Engine Lacks Power

Probable cause	Possible remedy
	Remove restriction or re-
line restricted	place the fuel line (par. 54).
Engine filled with carbon	Remove the cylinder head (par. 66) and clean carbon from engine.
Fuel strainer clogged	
Fuel mixture too lean	Adjust the carburetor (par. 56).
Ignition poor	Service or replace the spark plug (par. 62). Adjust the magneto breaker points (par. 61).
Air cleaner restricted	Service the air cleaner (par. 28).

Exhaust restricted	Remove and clean the muf-
	fler and pipe nipple (par. 49).
	/ -
Timing improper	Reset the timing (par 61).
Governor control out of	Adjust the governor spring
adjustment	(par. 58).

41. Engine Stops Suddenly

Probable cause	Possible remedy
Fuel tank emptyH	Fill the fuel tank with the
	proper grade of fuel (par.
	11).
Fuel strainer cloggedS	Service the fuel strainer (par. 54).
Carburetor defective(lean or replace the carbu-
	retor (par. 56).
Fuel tank cap air vent hole	
pluggedF	Remove the restriction
Air cleaner cloggedS	service the air claner (par.
	28).

42. Pump Fails to Function Properly

Probable cause	Possible remedy
Impeller broken, damaged, or wornRe	place the impeller (par.
Air entering the pump	•
bodyTig	ghten loose hose connections.
	Inspect the hoses for air eaks.
Suction valve defectiveRe	pair or replace the suc-
Seal defectiveRe	
Suction or discharge flange	
adapters looseTig	whten the suction and lischarge flange adapters par. 70).
Pump body defective Re	

43. Pump Noisy

Probable cause	Possible remedy			
Impeller loose, broken, or damaged	• • • • • • • • • • • • • • • • • • • •	or	impeller replace a eller (par.	
Seal defective	Replace the	e seal	(par. 70).	

body (par. 70).

44. Pump Fails to Prime

Probable cause	Pos	ssible	remedy	
Engine speed too slowIncre Liquid loss in pump volute _ Repr	ease	the	engine	speed.
1.0	٠١.			

Pump Fails to Deliver Rated Capacity 45.

Probable cause

Possible remedy

Pump not primed _____Prime the pump (par. 16). Engine speed too slow ____Increase the engine speed.

Pump Leaks

Probable cause

Possible remedy

Shaft seal assembly dry or

worn _____ Fill the shaft assembly (par. 70) with grease in accordance with the current lubrication order.

47. Field Expedient Repairs

Operational troubles may occur while the pumping unit is operating in the field where supplies and repair parts are not available and normal remedial action cannot be performed When this condition exists, the expedient remedies listed below may be used only upon the decision of the unit commander. Equipment so re-

paired must be removed from operation at the earliest possible moment and properly repaired before being placed in operation again.

Trouble

Expedient remedy

a. Air cleaner clogged

Remove the air cleaner (par. 59c).

Operating the unit in sandy or Caution: dusty areas without the air cleaner can cause serious damage to the engine.

Caution: Operating the unit with dirty fuel and no fuel strainer in the system can result in engine stoppage and damage to the carburetor.

b. Fuel line cracked or

c. Magneto stop switch

leaking _____ Wrap the line with plastic

tape (par. 54d).

defective ______Remove the stop switch and

tape the end of the switch lead (par. 61k).

d. Spark plug defective __Bend the electrodes closer together (par. 62c).

e. Engine cylinder head

gasket defective ______ Tighten down the cylinder head or mend the broken place (par. 66f).

Section IV. EXHAUST MUFFLER AND ENGINE COOLING SYSTEM

48. General

A combination fan and flywheel forces a flow of air through the flywheel shroud to circulate around the cylinder and cylinder head. The exhaust muffler and breather line are mounted on the cylinder crankcase.

49. **Exhaust Muffler**

- a. Remove and install the exhaust muffler as shown by figure 11.
 - b. Clean and inspect.

Cylinder Head Cover and Flywheel Shroud

- a. Remove and install the rope starting sleeve (par. 64).
 - b. Disconnect the ignition cable (par. 62).
 - c. Remove and install the flywheel (par. 65).
- d. Remove and install the cylinder head cover and flywheel shroud as shown by figure 12.
 - e. Clean and inspect.

51. Engine Crankcase Breather Line

- a. Remove and install the engine crankcase breather line as shown by figure 11.
 - b. Clean and inspect.

Section V. FUEL SYSTEM

52. **General**

The engine fuel system consists of a fuel tank, a combination shutoff cock and fuel strainer, a fuel line from the strainer to the float-type carburetor, governor control assembly and linkage, and an air cleaner. The fuel system is a gravityfeed type requiring no fuel pump. Fuel flows from the tank to the fuel line strainer which removes solids and water from the fuel, collecting this foreign matter in a removable sediment bowl. From the strainer the fuel passes into the carburetor. The oil-bath-type air cleaner removes dust and grit from the air and passes clean air to the carburetor, where it is mixed with the fuel for proper combustion.

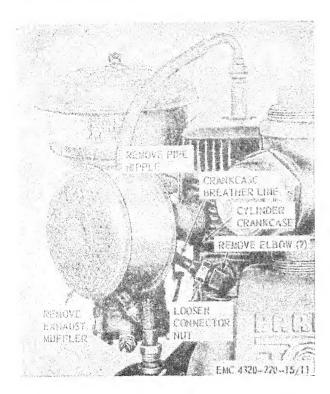


Figure 11. Exhaust muffler and crankcase breather line, removal and installation.

53. Fuel Tank, Cap, Screen, and Bracket

- a. Close the fuel shutoff cock (par. 54).
- b. Remove and install the cylinder head cover and spacer (par. 50).
- c. Remove and install the assembled fuel tank, cap, screen, and bracket from the cylinder crankcase as shown by figure 13.
 - d. Clean and inspect.

54. Fuel Strainer and Line

- a. Service, remove, and install the fuel strainer and line as shown by figure 14.
 - d. Clean and inspect.
- c. Perform field expedient repairs on the fuel line by wrapping with plastic tape.

Oil Fill Plug and Gauge and Oil Drain Plug

- a. Remove and install the oil fill plug and gage and oil drain plug as shown by figure 13.
 - b. Clean and inspect.

56. Carburetor

- a. Remove and install the air cleaner (par. 59).
- b. Close the fuel shutoff cock and remove and install the fuel line (par. 54).
- c. Remove and install the carburetor and the intake manifold as shown by figure 15. Discard gasket.
- d. Disassemble and reassemble the carburetor as shown by figure 16.
 - e. Clean and inspect.
- f. Adjust the carburetor as shown by figure 17.

57. Intake Manifold

- a. Remove and install the carburetor (par. 56).
- b. Remove and install the intake manifold as shown by figure 15.
 - c. Clean and inspect.

58. Governor Control Assembly and Linkage

- a. Remove and install the exhaust muffler (par. 49).
- b. Remove and install the governor control assembly as shown by figure 18.
- c. Disassemble and reassemble the governor control assembly and linkage as shown by figure 19.
 - d. Clean, inspect, and repair.
- e. Adjust the governor linkage as shown by figure 18.

59. Engine Air Cleaner and Bracket

- a. Remove and install the air cleaner bracket clip as shown by figure 12.
- b. Remove and install the engine air cleaner and bracket as shown by figure 20.
 - c. Clean and inspect.
 - d. Service the air cleaner (par. 28).
- c. Perform field expedient repairs on the air cleaner by operating the engine without the air cleaner and attaching a fine-meshed screen or cloth over the open carburetor to filter foreign particles.

('aution: Operation of the engine in sandy or dusty areas without the air cleaner can result in damage to the engine.

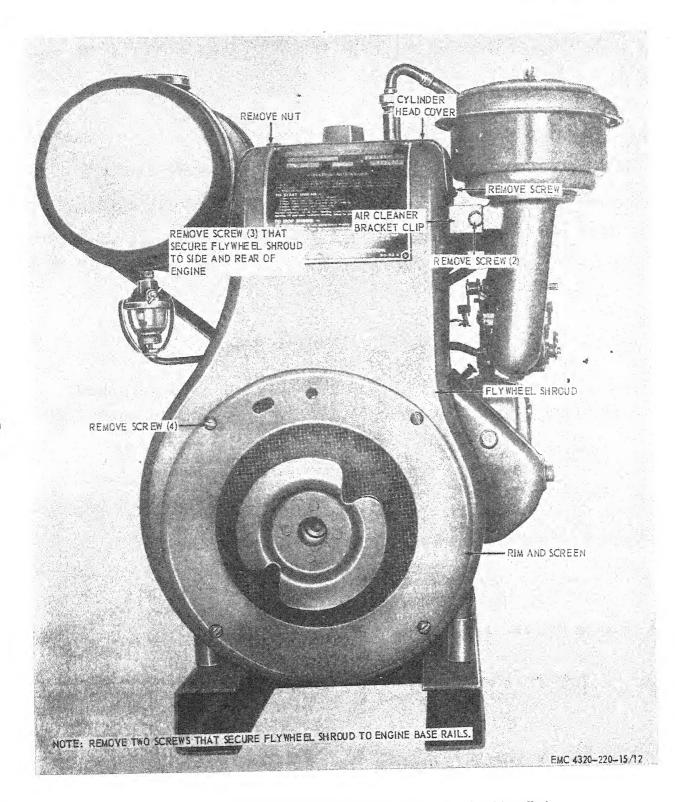


Figure 12. Cylinder head cover and flywheel shroud, removal and installation.

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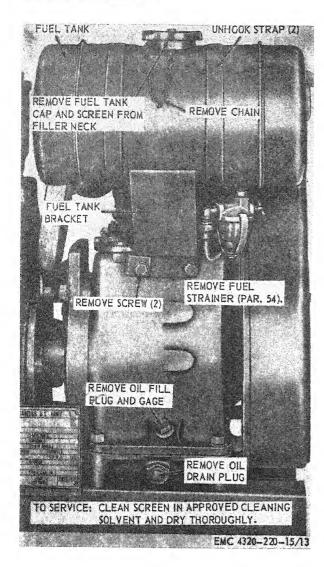


Figure 13. Fuel tank, cab, strainer, screen, oil fill plug and gage, and oil drain plug, removal and installation.

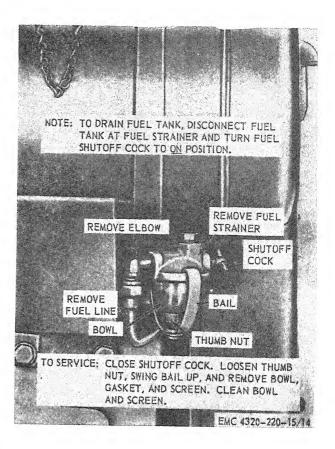


Figure 14. Fuel strainer and line, removal and installation, and fuel strainer servicing.

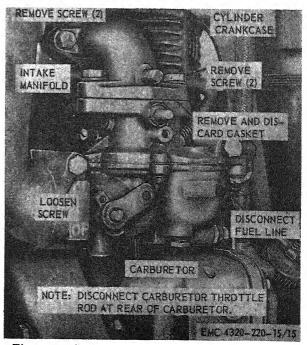
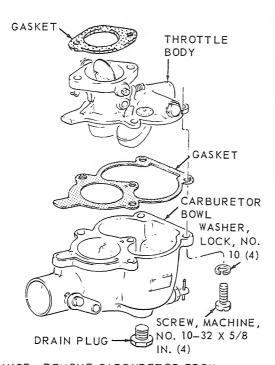
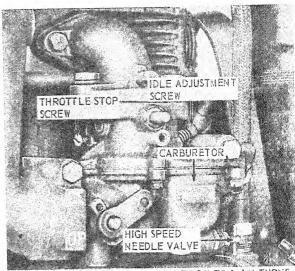


Figure 15. Carburetor and intake manifold, removal and installation.



TO SERVICE: REMOVE CARBURETOR FROM
ENGINE AND DRAIN FUEL FROM
CARBURETOR BOWL. SEPARATE
CARBURETOR BOWL FROM THROT—
TLE BODY. REMOVE FLOAT
AXIAL PIN AND REMOVE FLOATS.
REMOVE AND DISCARD GASKET.
CLEAN CARBURETOR BOWL IN
AN APPROVED CLEANING SOLVENT
AND DRY THROUGHLY. REAS—
SEMBLE CARBURETOR AND RE—
PLACE GASKET.

EMC 4320-220-15/16



STEP 1. SET IDLE ADJUSTMENT SCREW 3/4 TO 1-1/4 TURNS OPEN.

STEP 2. SET HIGH SPEED NEEDLE VALVE 1-1/2 TO 2 TURNS OPEN.

STEP 3. START ENGINE AND ALLOW IT TO REACH OPERAT-ING TEMPERATURE (PAR. 16).

STEP 4. WITH ENGINE AT OPERATING SPEED, TURN HIGH—
SPEED NEEDLE VALVE CLOCKWISE UNTIL ENGINE
RUNS UNEVENLY OR MISSES. TURN COUNTER—
CLOCKWISE UNTIL ENGINE SMOOTHS OUT AND
REGAINS FULL SPEED.

STEP 5. IDLE ENGINE.

STEP 6: TURN IDLE ADJUSTMENT SCREW CLOCKWISE UNTIL ENGINE RUNS UNEVENLY. TURN COUNTERCLOCK—WISE UNTIL ENGINE RUNS SMOOTHLY.

STEP 7. TURN THROTTLE STOP SCREW IN AND OUT TO OB-TAIN PROPER IDLING SPEED. EMC 4320-220-15/17

Figure 17. Carburetor adjustment.

Figure 16. Carburetor, disassembly and reassembly, and carburetor servicing

Section VI. IGNITION SYSTEM

60. General

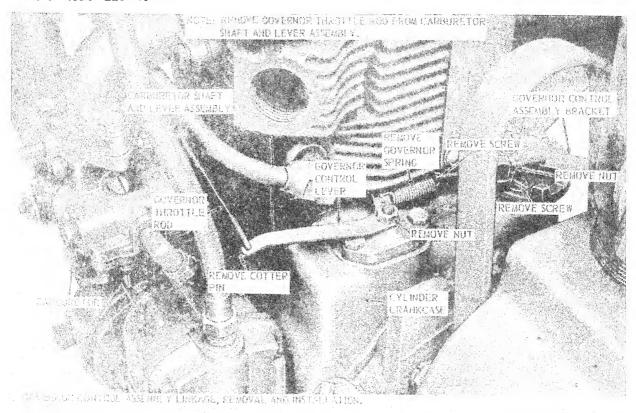
The ignition system consists of a high-tension magneto, magneto stop switch, spark plug, and cable. The magneto, driven off camshift gear is fitted with an impulse coupling that provides a powerful spark for easy starting and retards the timing of the spark to eliminate danger of kickback.

61. Magneto

a. Test the magneto ignition spark as shown by figure 21.

- b. Remove the end cover plate as shown by figure 22.
- c. Remove and install the magneto contact set and capacitor as shown by figure 23.
- d. Adjust the magneto contact points as shown by figure 23.
- e. Remove the magneto as shown by figure 22.
- f. Service the magneto air vent as shown by figure 22.
- g. Remove and install the magneto timing gear as shown by figure 24.

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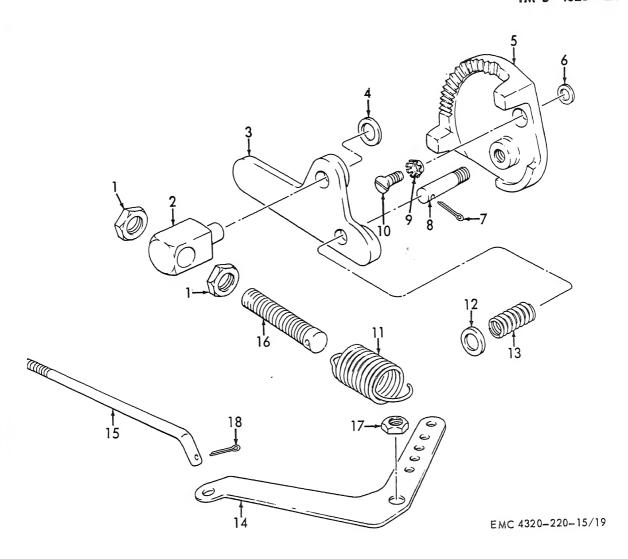


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TO THE STATE OF THE STATE OF A STATE OF THE STATE OF THE

Em. 4320 724-13 in

Papace N to the mean water assembly and taking exeminal and installation, and executor linkage adjustment.



- 1 Nut, hex, NO. 10-32 (2 rqr)
- 2 Adjusting screw block
- 3 Governor control lever
- 4 Washer, flat, 5/32 x 3/8 x 1/32 in.
- 5 Governor control bracket
- 6 Gasket
- 7 Pin, cotter, $1/16 \times 1/2$ in.
- 8 Lever support pin
- 9 Washer, lock, cask, 1/4 in.

- 10 Screw, machine, 1/4-20 x 5/8 iin.
- 11 Spring
- 12 Washer, flat, 1/4 x 1/2 x 1/16 in.
- 13 Spring
- 14 Governor control lever
- 15 Governor throttle rod
- 16 Governor spring sdjusting pin
- 17 Nut, hex, 1/4-28
- 18 Pin, cotter, 3/64 x 1/2 in.

Figure 19. Governor control assembly and linkage, disassembly and reassembly.

- h. Aline the magneto timing marks as follows:
 - (1) Remove the spark plug (par. 62).
 - (2) Remove the flywheel shroud screen (par. 50).
 - (3) Aline the magneto timing marks as
- shown by figure 25.
- i. Install the magneto as shown by figure 22.
- j. Clean and inspect.
- k. Perform field expedient repairs on the magneto stop switch by removing the stop switch and taping the end of the switch lead.

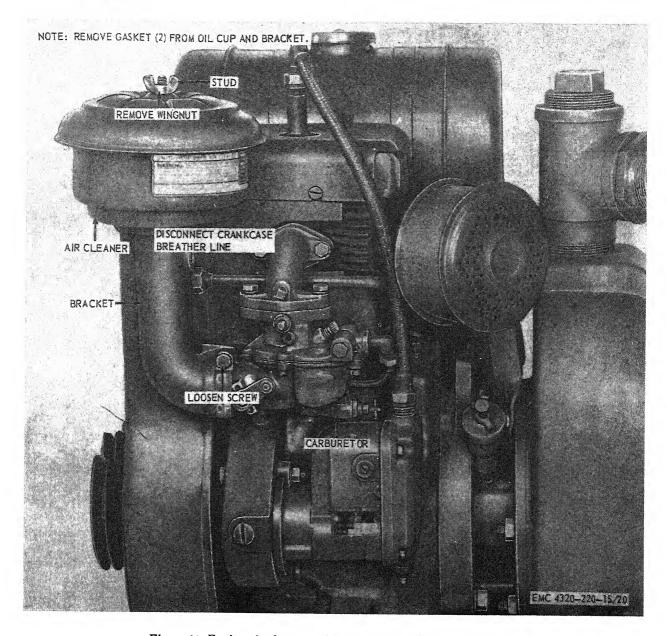


Figure 20. Engine air cleaner and bracket, removal and installation.

62. Spark Plug and Ignition Cable

- a. Remove and install the spark plug and ignition cable as shown by figure 26.
- b. Clean and inspect.
- c. Perform field expedient repairs on the spark plug by bending the electrodes closer together.

Section VII. ENGINE AND ACCESSORIES

63. General

This unit is equipped with a single-cylinder 4-cycle, L-head, air-cooled, gasoline-driven engine mounted on two base rails. The engine is manually started by use of a rope starting sheave. The sheave, located on the front of the engine, secures the flywheel on the crankshaft. The flywheel is a combination fan and flywheel



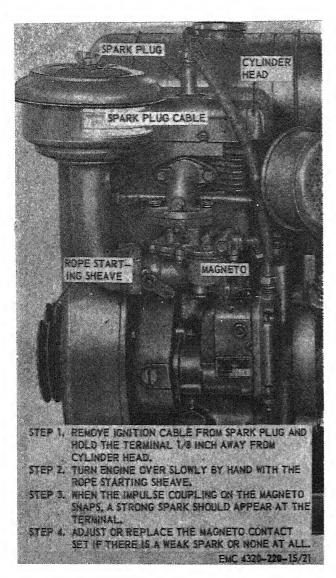


Figure 21. Testing magneto ignition spark.

and like the cylinder head, acts as an integral part of the engine cooling system. The engine utilizes a plunger-type oil pump, centrifugal, flyweight-type governor, and magneto ignition.

64. Rope Starting Sheave

- a. Remove and install the rope starting sheave shown by figure 27.
 - b. Clean and inspect.

Section VIII. CENTRIFUGAL PUMP

69. General

The pump is a centrifugal-type unit that is directly coupled to the engine. The pump body

65. Flywheel

- a. Remove and install the rope starting sheave (par. 64).
- b. Remove and install the flywheel shroud rim and screen (par. 50).
- c. Remove and install the flywheel as shown by figure 28.
 - d. Clean and inspect.

66. Cylinder Head

- a. Remove and install the spark plug and ignition cable (par. 62).
- b. Remove and install the cylinder head cover and spacer (par. 50).
- c. Remove and install the cylinder head as shown by figure 29.
- d. Tighten the cylinder head screws in proper sequence as shown by figure 30.
 - e. Clean and inspect.
- f. Perform field expedient repairs on the cylinder head gasket by laying a piece of primary wire across the broken place and tightening down the cylinder head.

67. Intake and Exhaust Valves Inspection Cover Plate

- a. Remove and install the spark plug (par. 62).
- b. Remove and install the carburetor (par. 56).
- c. Remove and install the valves inspection cover plate as shown by figure 31.
 - d. Clean and inspect.
- e. Adjust the valve lifters as shown by figure 31.

68. Engine and Base Rails

- a. Remove, disassemble, reassemble, and install the centrifugal pump (par. 70).
- b. Remove and install the engine and base rails as shown by figure 32.
 - c. Clean and inspect.

houses the impeller and check valve and serves as a water chamber with suction and discharge ports. The check valve prevents fluid backflow through the pump body.

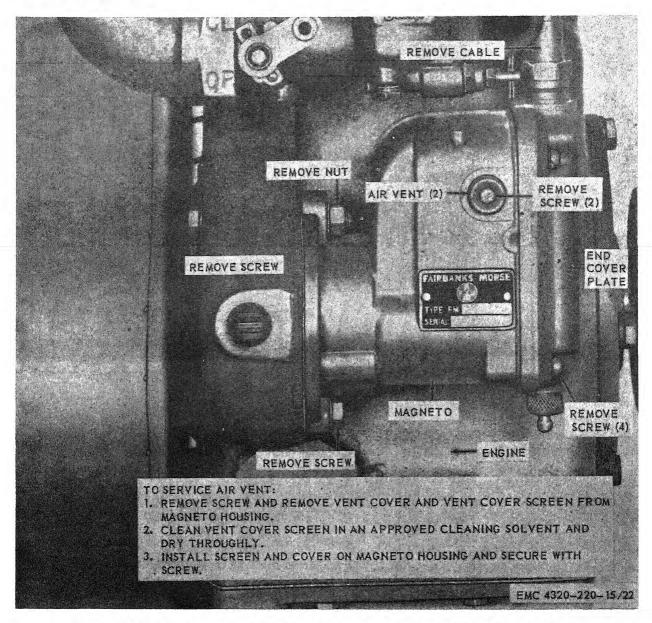


Figure 22. Magneto and end cover plate, removal and installation, and magneto air vent servicing.

70. Centrifugal Pump

a. Remove, disassemble, reassemble, and install the centrifugal pump as shown by figure 33.

Note. Disconnect the ignition cable from the spark plug before removing and disassembling the pump.

b. Clean, inspect, and repair.

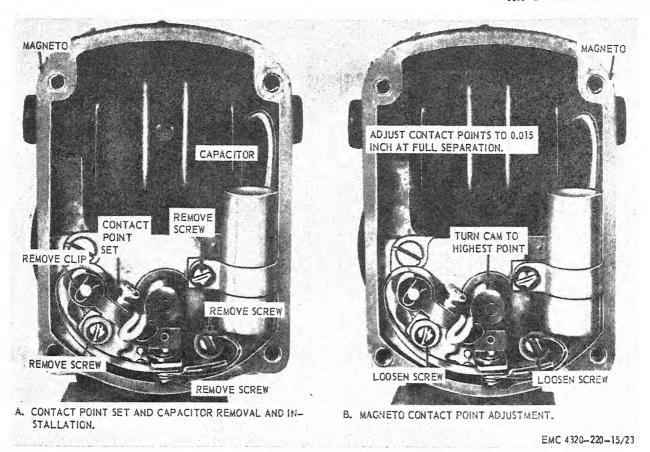


Figure 23. Magneto contact set and capacitor, removal and installation, and contact points adjustment.

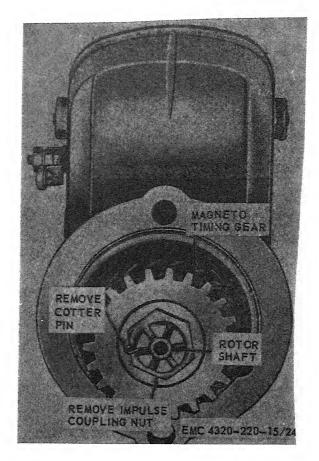


Figure 24. Magneto timing gear, removal and installation

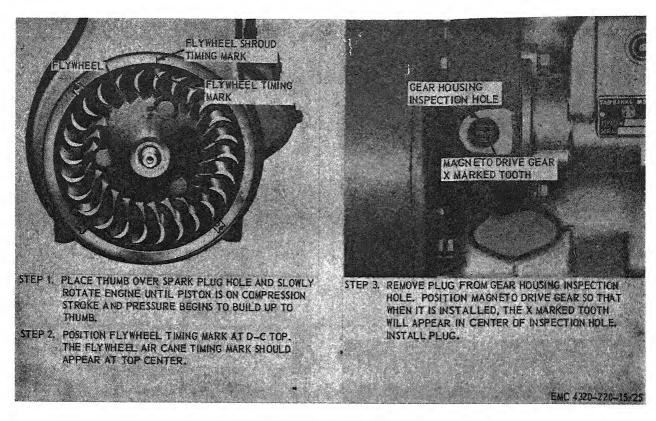


Figure 25. Magneto timing marks.

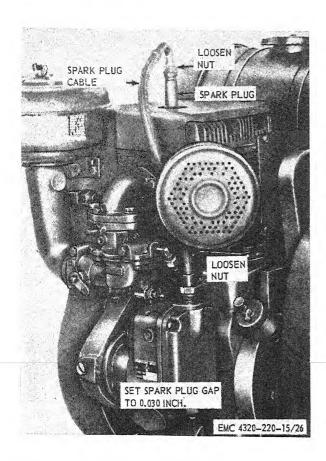


Figure 26. Spark plug and ignition cable, removal and installation.

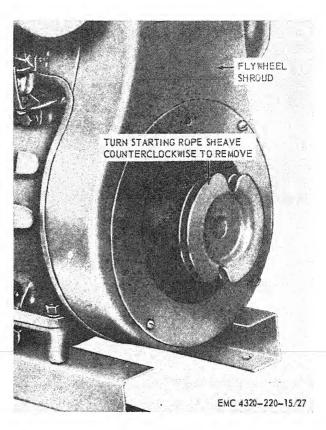


Figure 27. Rope starting sheave, removal and installation.

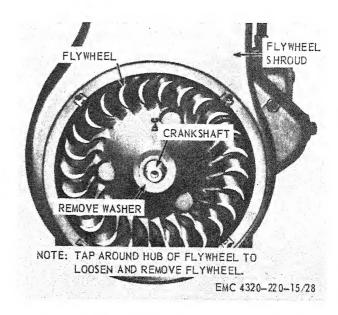


Figure 28. Flywheel, removal and installation.

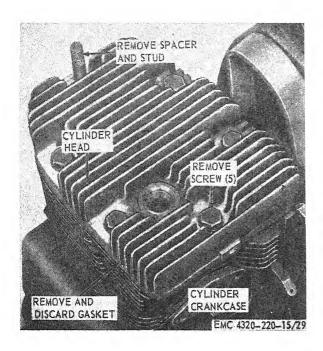


Figure 29 Cylinder head, removal and installation.

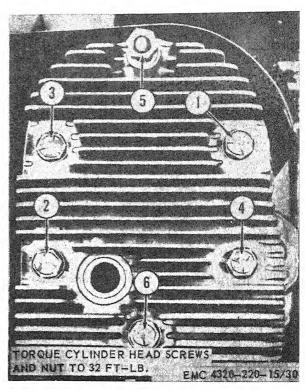


Figure 30. Cylinder head, tightening sequence.

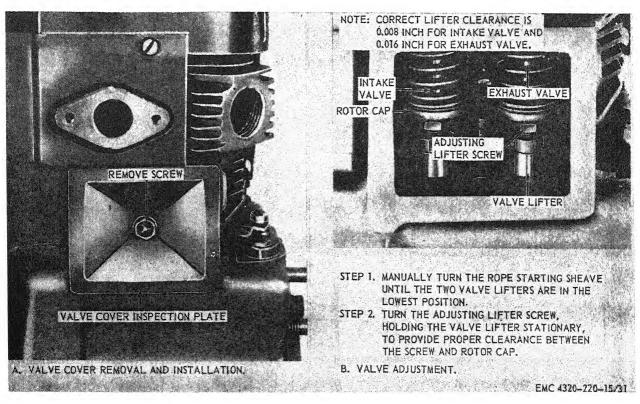


Figure 31. Intake and exhaust valves inspection cover plate, removal and installation.
and valve lifters adjustment.

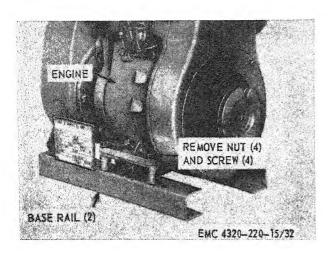


Figure 32. Engine and base rails, removal and installation.

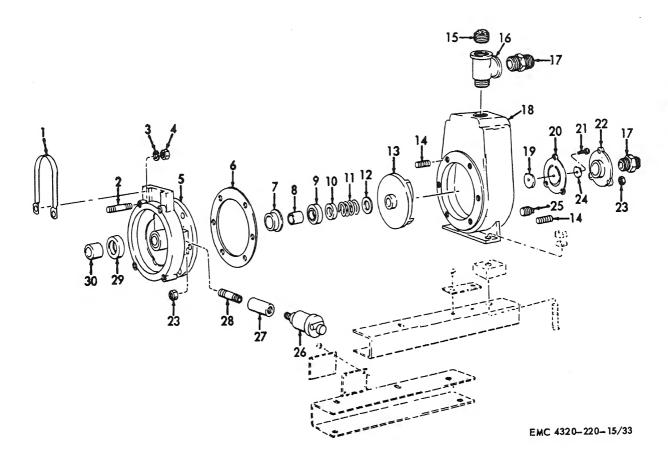
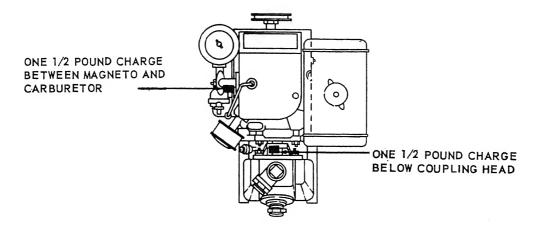


Figure 33. Centrifugal pump, removal, disassembly, reassembly, and installation.

- 1 Lifting handle
- 2 Stud, plain, $7/16 \times 2-1/2$ in.
- 3 Washer, lock, 7/16 in, (4 rqr)
- 4 Nut, hex, plain, 7/16-14 (4 rqr)
- 5 Coupling head
- 6 Gasket
- 7 Retaining ring
- 8 Bushing
- 9 Rotating ring
- 10 Nonmetallic washer
- 11 Spring
- 12 Washer, flat /in.
- 13 Impeller
- 14 Stud, plain, 3/8-16 x 1-1/2 in. (9rqr)
- 15 Plug, pipe 2-11- 1/2 in.

- 16 Tee, pipe, 2-11-1/2 in.
- 17 Adapter (2 rqr)
- 18 Pump body
- 19 Check valve weight
- 20 Check valve gasket
- 21 Screw, machine, 1/4-20 x 5/8 in.
- 22 Pipe flange
- 23 Nut, hex, plain 3/8-16 in. (11 rqr)
- 24 Check valve weight
- 25 Plug, pipe, 1-1/2-11-1/2 in.
- 26 Grease cup
- 27 Coupling pipe, 1/4-18
- 28 Nipple, pipe, $1/4-18 \times 1-1/2$ in.
- 29 Seal
- 30 Bushing

Figure 33-Continued.



LEGEND: 1/2 POUND CHARGE

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Figure 34. Placement of charges.

CHAPTER 4

DEMOLITION OF THE CENTRIFUGAL PUMP TO PREVENT ENEMY USE

71. General

When capture or abandonment of the centrifugal pump to an enemy is imminent, the responsible unit commander must make the decision either to destroy the equipment or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is essential to destroy the same vital parts of all centrifugal pumps and all corresponding repair parts.

72. Demolition to Render the Centrifugal Pump Inoperative

- a. Mechanical Means. Use an axe, sledge hammer, pick, pickmattock, or tools available to punch holes in the fuel tank and inflict severe damage to such items as the pump assembly carburetor, magneto, governor, engine crankcase, shroud, and manifold.
- b. Misuse. Drain the engine crankcase. Pour sand, gravel, bolts, or broken glass into the fuel tank and pump priming hole. Run the engine until the centrifugal pump fails.

73. Demolition by Explosives or Weapons' Fire

- a. Explosives. Place demolition charges as shown by figure 34 and detonate them simultaneously. Use as many of the charges listed in figure 34 as time permits.
 - (1) One 1/2-pound charge between magneto and carburetor.
 - (2) One 1/2-pound charge below coupling head.
 - b. Weapons' Fire. Fire on the centrifugal

pump with the heaviest practical weapons available.

74. Other Demolition Methods

- a. Scattering and Concealment. Remove all easily accessible parts such as the air cleaner, carburetor, and magneto and scatter them through dense foliage, bury them in dirt or sand, or throw them in a lake, river, stream, or other body of water.
- b. Burning. Pack rags, clothing, or canvas under or around the engine and pump assembly. Saturate this packing with gasoline, oil, or diesel fuel and ignite.
- c. Submersion. Knock the spark plug base from the engine with any convenient tool and remove the oil drain plug. Completely submerge the centrifugal pump in a body of water to provide water damage and concealment. Salt water will do greater damage to metal parts than fresh water.

75. Training

All operators should receive thorough training in the destruction of the centrifugal pump. Refer to FM 5-25. Simulated destruction, using all of the methods listed above, should be included in the operator training program. It must be emphasized in training, that demolition operations are usually necessitated by critical situations when time available for carrying out destruction is limited. For this reason, it is necessary that operators be thoroughly familiar with all methods of destruction of equipment and be able to carry out demolition instructions without reference to this or any other manual.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE

Section I. SHIPMENT WITHIN ZONE OF INTERIOR

76. Preparation of Equipment for Shipment

- a. General. Detailed instructions for the preparation of Engineer equipment for domestic shipment are outlined within this paragraph. Preservation will be accomplished in sequence that will not require the operation of previously preserved components.
- b. Inspection. Equipment will be examined for any unusual conditions such as damage, rusting, accumulation of water, and pilferage. DA Form 464, Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment, will be executed for the equipment.
- c. Cleaning and Drying. Cleaning by an approved technique is the first essential procedure in any effective preservation process. Approved methods of cleaning, drying, types of preservatives and methods of application are described in TM 38–230.
- d. Painting. Paint all surfaces when the paint has been removed or damaged. Refer to TB EN 60 for detailed cleaning and painting instructions.
 - e. Depreservation Guide.
 - (1) A properly annotated Depreservation Guide will be completed concurrently with preservation for each item of mechanical equipment; any peculiar requirements will be outlined in the Remarks column. The completed Depreservation Guide will be placed in a waterproof envelope, marked "Depreservation Guide", and fastened in a conspicuous location on or near the operator's controls.
 - (2) Prior to placing equipment in operation, or to the extent necessary for inspection, depreservation of the item

- shall be performed as outlined on the Depreservation Guide.
- f. Lubrication System. Check level of lubricant. Operate the engine at a fast idle until lubricant has been circulated throughout the system. Drain the crankcase and reinstall the drain plugs.
- g. Sealing of Openings. Openings that will permit the direct entry of water into the interior of gasoline engine-driven equipment shall be sealed with waterproof, pressure-sensitive, adhesive tape conforming to Specification PPP-T-60, type III, class 1.
- h. Fuel Tank. Drain fuel tank after engine preservation and fog interior with preservative oil (P-10) conforming to Specification MIL-L-21260, grade 2.
- i. Air Cleaner. Drain the air cleaner and seal all openings that permit the direct entry of water. Use waterproof, pressure-sensitive adhesive tape conforming to PPP-T-60, type III, class 1.
- j. Exposed Surfaces. Coat exposed machined ferrous metal surfaces with preservative (P-6) conforming with Specification MIL-C-11796, class 3. If preservative is not available, cup grease may be used.
- k. Marking. Marking shall conform to MIL-STD-129.
- l. Pumps. Spray interior of pump with preservative oil (P-3) conforming to MIL-C-16173 grade 3, except preservative oil (P-14) conforming to MIL-C-10382 shall be used for pumps used in portable water systems. Seal openings that will permit the direct entry of water with waterproof, pressure-sensitive adhesive tape conforming to PPP-T-60 type III,

class 1.

- m. Disassembly, Disassembled Parts and Basic Issue Items.
 - (1) Disassembly shall be limited to the removal of parts and projecting components that tend to increase the overall profile of the equipment and to those subject to damage or pilferage.
 - (2) Disassembled items shall be packed with the publications in the tool box if possible. Otherwise items will be packed in a suitable container and se-

cured to the equipment to prevent loss or pilferage.

n. Packing. If packing is required to provide adequate protection against damage during shipment, refer to TM 38-230 for guidance in crate fabrication.

77. Loading Equipment for Shipment

Load the centrifugal pump on the carrier by using a handtruck, forklift, or manpower, and block or tie it down to prevent shifting during transportation.

Section II. LIMITED STORAGE

78. Preparation of Equipment for Storage

- a. General. Limited storage is defined as a period not to exceed 6 months. Detailed instructions for preparation of this equipment for limited storage are listed in this paragraph. Refer to AR 743-505 for additional information.
- b. Inspection. Make a complete inspection of the centrifugal pump as described in paragraph 9. Correct all deficiencies as necessary or report to field maintenance.
- c. Cleaning and Drying. As outlined in paragraph 76.
 - d. Painting. As outlined in paragraph 76.
- e. Depreservation Guide. Will be completed as outlined in paragraph 76.
- f. Lubrication System. As outlined in paragraph 76, except crankcase will not be drained for limited storage.
- g. Sealing of Openings. As outlined in paragraph 76.
 - h. Fuel Tank. As outlined in paragraph 76.
- i. Exterior Surfaces. As outlined in paragraph 76.
- j. Pump Interior. As outlined in paragraph 76.
- k. Disassembly. Disassembled Parts, and Basic Issue Items. Will be preserved and packaged as outlined in paragraph 76.
- l. Weather-proofing. When suitable shelter is not available, select a firm, level, well-drained storage location, protected from prevailing winds.

Position the equipment on heavy planking or other solid surfaces. Cover the equipment with a tarpaulin or other suitable waterproof covering and tie down securely.

79. Inspection and Maintenance of Equipment in Storage

- a. Inspection. When equipment has been placed in storage, all scheduled preventive maintenance services including inspection will be suspended and preventive maintenance inspection will be performed as specified herein. Refer to AR 743-505.
- b. Worksheet and Preventive Maintenance. DA Form 464 will be executed on each major item of equipment when equipment is initially placed in storage and every 30 days thereafter. Required maintenance will be performed promptly to insure that the equipment is mechanically sound and ready for immediate use.
- c. Exercising. Equipment in limited storage must be operated long enough to bring it up to operating temperature and for complete lubrication of all bearings, gears, and the like, at least every 30 days. Equipment must be serviced and in satisfactory operating condition before it is operated. After each exercising period equipment will be represerved as outlined in paragraph 78.

CHAPTER 6 FIELD AND DEPOT MAINTENANCE REPAIR INSTRUCTIONS

Section I. GENERAL

80. Scope

a. The following instructions are provided for the use of field and depot maintenance personnel. They contain information on the maintenance of the equipment which is beyond the scope of the tools, equipment, personnel, or supplies normally available to organizational maintenance facilities.

b. Appendix I contains a list of all publications applicable to field and depot maintenance

facilities for this equipment. Appendix II contains the Maintenance Allocation Chart.

81. Field and Depot Maintenance Record and Report Forms

For record and report forms applicable to third, fourth, and fifth echelons of maintenance refer to TM 5-505, Maintenance of Engineer Equipment.

Section II. DESCRIPTION AND DATA

82. Description

For a complete description of the centrifugal pump, refer to paragraph 3.

83. Field and Depot Maintenance Tabulated Data

a. Nut and Bolt Torque Data.

Engine base screws 7 to 9 ft-lb
Connecting rod nuts 18 ft-lb
Crankshaft main bearing
plate screws 26 to 32 ft-lb
Pump base screws 7 to 9 ft-lb

b. Adjustment Data.
 Valve lifter (intake and exhaust)

Engine cold (intake) 0.008 in. Engine cold (exhaust) 0.016 in c. Engine Repair and Replacement Standards. Table II lists manufacturer's sizes, tolerances, clearances, and the maximum allowable wear and clearances for the Wisconsin Engine, Model MAENLD.

d. Time Strandards. Table III lists the number of man-hours required under normal conditions for various operations in the maintenance and repair of the centrifugal pump. The manhours listed are not intended to be rigid standards. Under adverse conditions, the operations will take considerably longer; whereas, under ideal conditions with highly skilled mechanics, most of the operations can be accomplished in considerably less time.

Table II. Engine Repair and Replacement Standards

	Manufacturer's dimensions and tolerances inches			ired ance	Maximum allowable wear in inches	Maximum allowable clearance in inches
	Min	Max	Min	Max		
Cylinder						
Cylinder bore	3.000	3.003				0.003
Cylinder taper	0.003	0.0035				
Cylinder out or round		0.0005				
Crankshaft						
Journal width	1.250	1.255				
Journal diameter main bearing	1.325					
Journal diameter (rod)	1.125	1.126				0.002
Journal taper		0.0005				
Journal out of round		0.0005				
Runout, flywheel end	1	0.007				
End play	1		0.001	0.003		
	(E:	ngine cold)				
Journal shoulder fillet radius	0.125					
Crankshaft length	14.625					
Camshaft						
Support pin length	6.625					
Support pin diameter	0.490					
Piston and Pin						
Piston skirt clearance	1		0.003	0.0035		
Piston diameter	2.995	3.000				0.0005
Piston pin length	2.5625					
Piston pin diameter	0.749	0.750				0.001
Piston to rod bushing clearance		0.0005	0.001			
Piston Rings						
End gap (when fitted in cylinder)		0.012	0.022			
To groove (total both sides)						
Top compression ring to groove			0.002	0.0035		
Two compression and scraper rings			0.001	0.0025		
Oil ring			0.0025	0.004		
Spark						
Advance (ahead of top dead center)		20°				
Connecting Rod Bearing						
Rod bearing inside diameter	1.12670	1.12700			ł	
Connecting Rod Sleeve Bearing						
Inside diameter	0.0495	0.750				0.000
Sleeve bearing length	1.127					
Connecting Rod Bearing						
End play (side clearance)			0.004	0.010		
Bearing to journal clearance		1	0.007	0.002		
Connecting Rod						
Center to center	8.000					
Valves, Valve Guides, and Valve Lifters						
Valve head diameter	1.250					
Valve stem diameter	0.3080	0.3090				0.00
Valve stem to guide			0.003	0.008	;	0.00
	0.3120	0.3130			1	0.00

Table II. Engine Repair and Replacement Standards-Continued

	Manufacturer's dimensions and tolerances inches		Desir cleara		Maximum allowable wear in inches	Maximum allowable clearance in inches
	Min	Max	Min	Max		
Valves, Val	ve Guides,	and Valve	 Lifters (Con	ťd)		
Lifter diameter	0.648					0.002
Lifter clearance in guide			0.001	0.0025		
Lifter length overall	3.125					
Camshaft						
Camshaft support pin diameter	0.4900	0.4905			1	0.002
Camshaft and gear inside diameter	0.4920	0.4930				0.002
Oil Pump						
Plunger-to-bore	0.003	0.004				
Plunger diameter	0.625					
Plunger length	0.940					
Rod diameter	0.247					
Rod length	4.5625					
Pump, Water			0.005		1	
Impeller-to-body face clearance			0.005	0.0	10	

Table III. Time Standards

	Lubrication and Service		Lubrication and Serivce
	Hours		Hours
01	ENGINE		
	0100 ENGINE ASSEMBLY Engine assembly, gasoline (drain and refill with new oil) 0.3	0101	CRANKCASE, BLOCK, CYLINDER HEAD Head, cylinder
03	FUEL SYSTEM 0304 AIR CLEANER Air cleaner, intake (clean and refill with new oil) 0.1 0306 TANKS, LINES, FITTINGS Tank, fuel assembly (drain and flush tank) 0.2 0309 FUEL FILTERS		(include removal and installation of spark plug and cover) 0.5 Cylinder and crankcase assembly (engine removed) (include removal and installation of head, carburetor, magneto, flywheel and housing 6.0
	Strainer assembly (clean strainer) 0.2	0102	CRANKCASE
	COOLING SYSTEM 0502 COWLING, DEFLECTORS, AIR DUCT, SHROUD Screen		Crankcase assembly (engine removed) (includes removal and installation of base, head, air shroud and flywheel) 3.5
55	(cleaning) 0.1 PUMPS (EXCLUDE ENGINE PUMPS) 5505 LUBRICATORS Cup, grease (refill grease cup) 0.1 Remove and Replace	0103	FLYWHEEL ASSEMBLY Flywheel, crankshaft (includes removal and installation of starting pulley and screen) 0.5
01	ENGINE 0100 ENGINE ASSEMBLY Engine assembly, gasoline (includes removal and	0104	PISTONS, CONNECTING RODS Piston, internal combustion engine (inculdes removal and installation of head cylinder and base
	installation of pump body,		oil pan) 3.0
	impeller and head coupling 3.0		53

Table III. Time Standards-Continued

		Hor	iro			How	rs
		Rod assembly, connecting	673		0000	ENGINE SPEED GOVERNOR	
		(includes removal and			0308	Flyweight assembly	
		installation of head cylinder				(engine removed) (includes	
		and base oil pan)	2.5			removal and installation	
	0105.1	VALVES				of camshaft)4	1.5
		Valve and insert			0308.4	GOVERNOR CONTROLS	
		(includes removal and			0300.4	Control assembly	0.3
		installation of carburetor			0000	FUEL FILTERS	
		and head cylinder)	3.0		0309	Strainer assembly (0.3
		Pin, hollow			~~~~		0.0
		(includes removal and		04		UST SYSTEM	
		installation of carburetor	~ =		0401	MUFFLER AND PIPES	A =
		and head cylinder)	2.5			Muffler, exhaust(0.1
	0105.2	ROCKER ARMS, TAPPETS		05	COOLIN	NG SYSTEM	
		Lifter, valve			0502	COWLING, DEFLECTORS,	
		(engine removed) (includes				AIR DUCT, SHROUD	
		removal and installation				Shroud	
		of base oil pan, governor and crankshaft and camshaft)				(include removal and	
		(includes adjustment)	6.1			installation of pulley,	0.6
	01050	CAMSHAFTS	0.2			flywheel and screen guard	0.0
	0105.3	Camshaft assembly		06		RICAL SYSTEM	
		(engine removed) (includes			0604.2	MAGNETO ASSEMBLY	
		removal and installation				Magneto, ignition	0.6
		of cranfshaft, rod, connecting				(includes retiming engine)	0.0
		base oil pan valves			0604.6	IGNITION COIL: WIRING,	
		and cylinder head)	4.0			SPARK PLUGS	Λ1
	0105.5	TIMING GEARS				Spark plugCable assembly	0.1
	OT00.0	Gear, helical			**********		0.1
		(engine removed) (include		55		S (EXCLUDE ENGINE PUMPS)	
		removal and installation			5 500	PUMP ASSEMBLY	
		of magneto crankshaft				Pump, centrifugal	
		and camshaft	4.6			(includes removal and	
	0106.1	OIL PUMP				installation of engine	2 /
		Body assembly				assembly and base rails)	0.0
		(include removal and			5501	VOLUTE, HOUSING	
		installation of base				Body, pump	0.6
		oil pan	1.0		5502	IMPELLER; ROTOR, DIAPHRAGM	
	0106.5	CRANKCASE VENTILATION				Impeller, pump, centrifugal	
		Line assembly, air breather	. 0.1			(includes removal and	
	0106.6	OIL PANS, LINES, LEVEL				installation of pump body)	0.7
		GAGE				Seal, shaft, assembly	
		Base, engine	. 0.5			(includes removal and	
	0108	MANIFOLDS				installation of pump	1.0
		Manifold, intake				body and impeller)	1.0
		(include removal and installation of carburetor	0.5		5504	DISCHARGE ASSEMBLY	
			. 0.0			Adapter	0.1
03		SYSTEM			5504.2	SLCTION VALVE, SUCTION	
	0301	CARABURETOR; FUEL				HEADS	
		INJECTOR Carburetor, float	0.4			Valve, lift, check	0.5
	0204	AIR CLEANER	. 0.2		5504.3		
	0304	Air cleaner, intake	0.1			Plug, pipe	0.1
	0904				5505	LUBRICATORS	
	0306	TANKS, LINES, FITTINGS Tank assembly, fuel	0.3			Cup, grease	0.2
		Talk assembly, tuel	. 0.0				

Possible remedy

Possible remedy

Possible remedy

Replace the spring (par.

Possible remedy

100). Replace the rings

(par. 100). Replace the cylinder crankcase (par.

108). Repair or replace

case (par. 108).

pump (par. 96).

(par. 98).

94).

Note. No special tools or equipment are required for the maintenance of the centrifugal pump by field and depot maintenance personnel.

FIELD AND DEPOT MAINTENANCE TROUBLESHOOTING

84. General Probable cause Cylinder bore worn or This section provides information useful in scored _____ Replace the cylinder crankdiagnosing and correcting unsatisfactory operation or failure of the centrifugal pump or its 89. **Engine Overheats** components. Each trouble symptom stated is followed by a list of probable causes of trouble. Probable cause The possible remedy recommended is described Oil pump defective ____Repair or replace the oil opposite the probable cause. Engine Is Hard to Start or Fails to Start 90. **Engine Backfires** Probable cause Possible remedy Probable cause Magneto defective _____Repair the magneto (par. Intake valve sticking ____Repair or replace the valve 94). Compression weak _____Repair or replace the de-Intake valve spring fective valves (par. 98). defective _____ 98.) Replace the defective piston rings (par. 100). 91. **Engine Lacks Power Engine Misses or Runs Erratically** Probable cause Probable cause Possible remedy Magneto defective _____Repair the magneto (par. Magneto defective _____Repair the magneto (par. 94). Valves defective _____Repair or replace the valves par 98.) Compression weak _____Replace the pistons (par. Governor defective _____Repair or replace the governor (par. 106). 87. **Engine Knocks** Probable cause Possible remedy Replace the cones and rol-Crankshaft cones and rollers defective. _____ lers (par. 104). Connecting rod loose ____ Replace the connecting rod par. 100). 92. Piston worn _____Replace the piston (par. 100). Cylinder bore worn Replace the cylinder crankexcessively. ____ case (par. 108). Piston pin loose _____Replace the connecting rod bushing (par. 100).

Engine Exhaust Smoky

Probable cause

the defective valves (par. Governor defective ____Repair or replace the governor (par. 106). **Engine Stops Suddenly** Probable cause Possible remedy Piston damaged _____Replace the piston (par. 100). Connecting rod broken ____Replace the connecting rod par. 100). Valve lifters loose ____ Replace the valve lifters Crankshaft broken ____Replace the (par. 104). Engine jumps time ____Replace the camshaft and Possible remedu camshaft gears (pars. 98 and 104). Piston or rings worn ____Replace the piston and/or rings (par. 100).

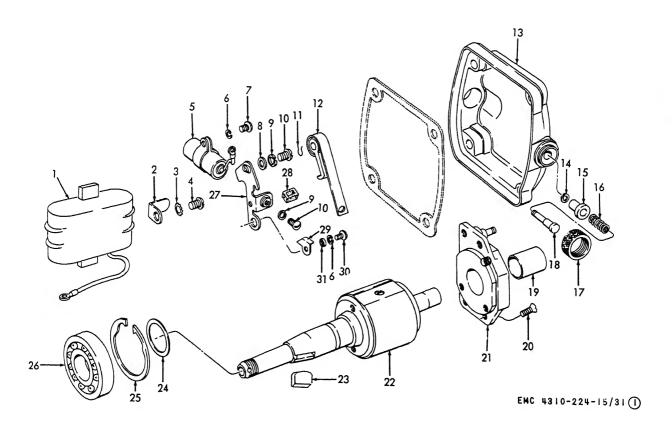
Section IV. MAGNETO

93. General

The main function of the magneto is to supply high-voltage current for the engine ignition system. The magneto consists of the contact set, capacitor, coil, magneto rotor, and impulse coupling. The contact set which provides a timed spark for ignition is actuated by the magnetic rotor. The impulse coupling is used to provide increased speed of the armature for starting the engine.

94. Magneto

- a. Remove and install the magneto (par. 61).
- b. Disassemble and reassemble the magneto as shown by figure 35.
- c. Aline the magneto drive gear as shown by figure 25.
 - d. Clean, inspect, and repair.
- e. Test the magneto coil on an ignition tester. Replace a defective coil.



- 1 Magneto coil
- 2 Coil clip
- 3 Washer, lock, No. 6

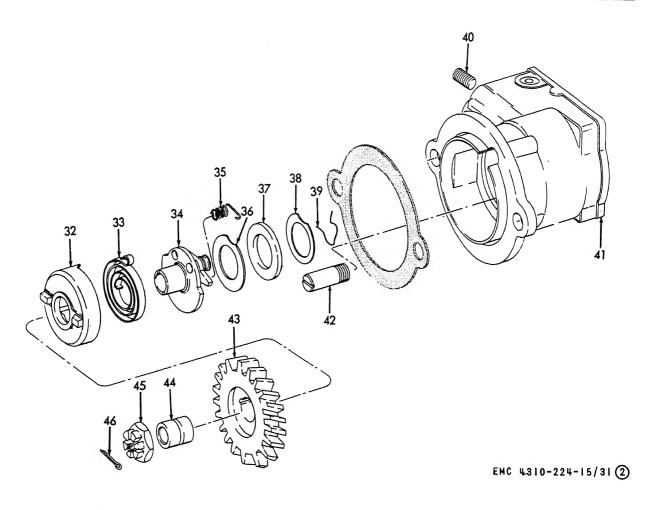
- 4 Screw, machine, No. 6-32 x 3/16 in.
- 5 Capacitor
- 6 Washer, lock, No. 8 (2 rqr)

Figure 35. Magneto, disassembly and reassembly.

- 7 Screw, machine, No. 8-32 x 1/4 in.
- 8 Washer, flat, brass, 9/64 in. id, 9/32 in. od, 1/64 in. thk
- 9/32 in. od, 1/64 in. thk 9 Washer, lock, No. 6 (2 rqr)
- 10 Screw, machine, No. 6-32 x 3/8 in. (2 rqr)
- 11 Fulcrum retaining ring
- 12 Breaker arm and spring
- 13 Ignition shield
- 14 Ground switch retaining ring
- 15 Bushing
- 16 Spring
- 17 Knurled nut
- 18 Pushbutton
- 19 Sleeve bearing

- 20 Screw, machine, No. 8-32 x 3/8 in.
- 21 Bearing support plate assembly
- 22 Magnetic rotor
- 23 Key, woodruff, No. 3
- 24 Shim (2 rqr)
- 25 Retaining ring
- 26 Annular ball bearing
- 27 Contact set support plate
- .28 Breaker arm flat wick
- 29 Cam wick holder
- 30 Screw, machine, No. 8-32 x 3/8 in.
- 31 Washer, flat, 5/32 in. id, 3/8 in. od, 0.049 in. thk

Figure 35—Continued.



32 Coupling shell

33 Drive spring

34 Hub assembly

35 Torsion spring

Figure 35-Continued.

36 Washer, flat, outer end, 5/8 in. id, 1-3/8 in. od, 1/32 in. thk

37 Plain seal

38 Washer, flat, inner end, 23/32 in. id, 1-17/64 in. od, 0.015 in. thk

39 Retaining ring

40 Setscrew, headless, 1/4-20 x 7/8 in. (2 rqr)

41 Magneto fame

42 Pawl stop pin

43 Drive gear

44 Sleeve bearing

45 Sleeve nut

46 Pin, cotter, 3/32 x 3/4 in.

Figure 35-Continued.

Section V. ENGINE BASE AND OIL PUMP

95. General

a. Engine Basa. The engine base supports the engine and forms the bottom of the crankcase. The base holds the engine lubricating oil. It is provided with an engine mounting base at each of the four corners and is fastened to the crankcase by a series of cap screws and lockwashers. Gasket paper between the base and the lower part of the crankcase provides a seal to prevent oil from leaking out of the crankcase.

b. Oil Pump. The oil pump is a plunger-type unit, mounted on the lower inside of the cylinder crankcase. It is operated by a cam-actuated plunger rod. The pump draws oil from the engine base and sprays it on the internal working components of the engine.

96. Engine Base and Oil Pump

- a. Drain the oil from the engine crankcase.
- b. Remove the oil from the engine air cleaner.
- c. Remove and install the engine (par. 68).
- d. Turn the engine on its side and remove and install the engine base as shown by figure 36.
- e. Remove and install the oil pump as shown by figure 37.
- f. To remove the push rod, remove and install the camshaft (par. 106).
- g. Disassemble and reassemble the oil pump as shown by figure 38.
 - h. Clean, inspect, and repair.

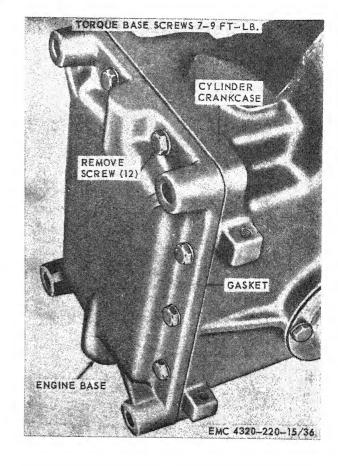


Figure 36. Engine base, removal and installation.

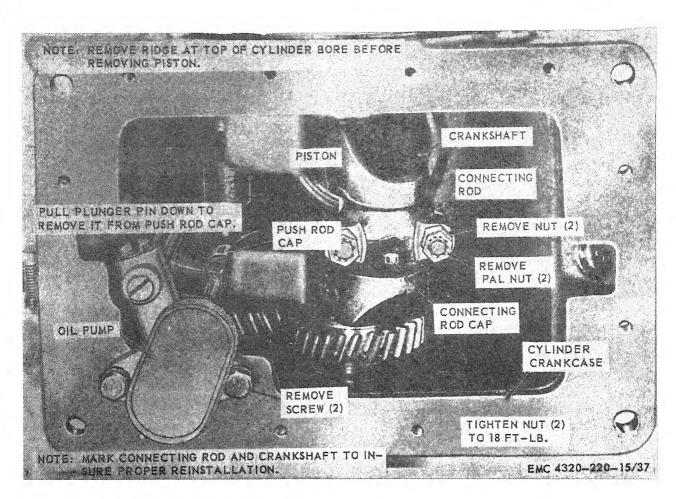
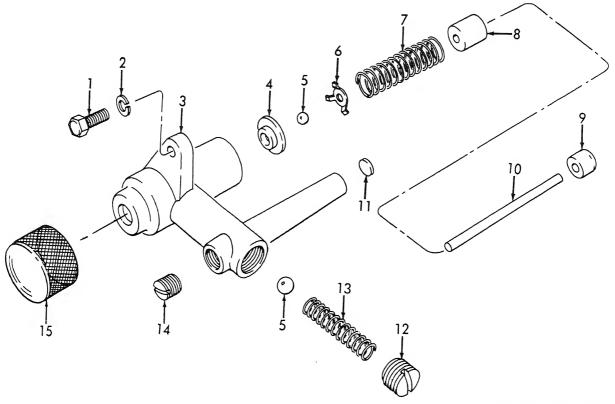


Figure 37. Oil pump and connecting rod and piston, removal and installation.



EMC 4320-220-15/38

- 1 Bolt, machine, hex-hd, 1/4-20 x 4/8 in. (2 rqr)
- 2 Washer, lock, 1/4 in. (2 rqr) 3 Oil pump body 4 Ball seat

- 5 Bearing ball, 5/16 in. dia (2 rqr)
- 6 Check ball retainer
- 7 Compression spring

- 8 Plunger
- 9 Push rod cap
- 10 Plunger pin
- 11 Expansion plug
- 12 Plug, pipe, 1/4-18
- 13 Compression spring
- 14 Plug, pipe, 1/8-27
- 15 Strainer

Figure 38. Oil pump disassembly and reassembly.

Section VI. INTAKE AND EXHAUST VALVES

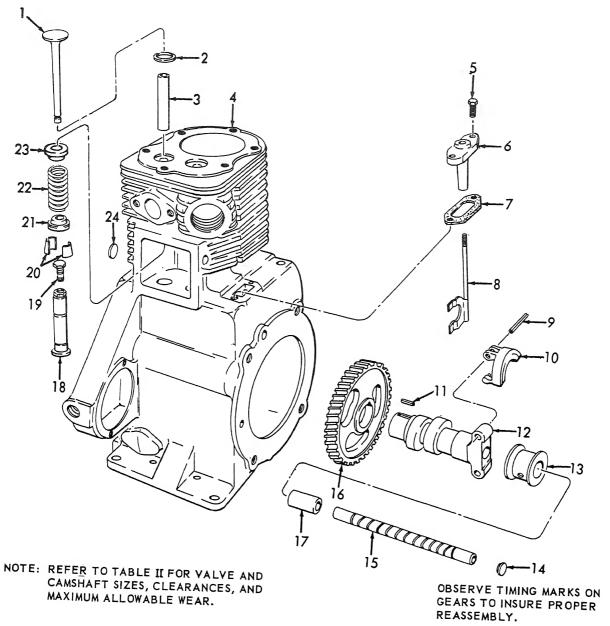
97. General

The valve system of the engine consists of 1 intake and 1 exhaust valve. Both valves are spring loaded and equipped with rotators to lessen the frequency of valve repair. The valve are accessible by removing the cylinder head and the valve inspection cover plate. Both valves operate in valve guides pressed into the cylinder crankcase. The valves and valve seat inserts are made of Stellite to resist burning. The function of the intake valve is to admit the fuel-air mixture to the combustion chamber while the exhaust valve controls the release of the exhaust gases from the combustion chamber.

98. Intake and Exhaust Valves

- a. Remove and install the engine cylinder head (par. 66).
- b. Remove and install the valve inspection cover plate (par. 67).

- c. Remove the intake and exhaust valves and related parts as shown by figure 39.
 - d. Clean and inspect.
- e. Reface the valves and grind seat inserts as follows:
 - (1) Using a valve face grinder, reface the valves to an angle of 45°.
 - (2) Install the pilot of correct size in the valve stem bore of the valve guide. Reface the stone on the stone refacer to the angle of 45°. Place the grinder and stone assembly over the pilot in the valve stem bore of the valve guide and grind just enough to make a smooth seat.
 - (3) Inspect the valve seats for concentricity with a dial indicator.
- f. Install the intaké and exhaust valves and related parts as shown by figure 39.
- g. Adjust the valve lifters as shown by fig 31.



EMC 4320-220-15/39

- 1 Valve (2 rqr)
- 2 Valve seat insert (2 rqr)
- 3 Valve stem guide (2 rqr)
- 4 Cylinder crankcase assembly
- 5 Screw, cap, hex-hd, 1/4-20 x 3/4 in. (2 rqr)
- 6 Support bracket
- 7 Governor yoke gasket

- 8 Governor yoke
- 9 Spring pin (2 rqr)
- 10 Governor rlyweight (2 rqr)
- 11 Key, woodruff, No. 3
- 12 Camshaft
- 13 Sleeve bearing
- 14 Expansion plug

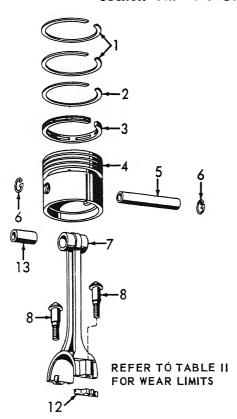
Figure 39. Valves and related parts, governor yoke, camshaft assembly and lifters, and governor flyweight assembly, disassembly and reassembly.

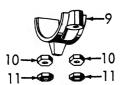
- 15 Camshaft support pin
- 16 Camshaft gear
- 17 Governor spacer
- 18 Valve lifter (2 rqr)
- 16 Adjusting screw (spec) (2 rqr)

- 20 Spring retainer lock (4 rqr)
- 21 Valve rotator (2 rqr)
- 22 Valve spring (2 rqr)
- 23 Spring centering seat
- 24 Expansion plug

Figure 39-Continued.

Section VII. PISTON AND CONNECTING ROD





EMC 4320-220-15/40

Figure 40. Connecting rod and piston, disassembly and reassembly.

- 1 Compression ring (2 rqr)
- 2 Scraper ring
- 3 Oil ring
- 4 Piston
- 5 Piston pin
- 6 Retaining ring (2 rqr)
- 7 Connecting rod
- 8 Bolt, shoulder, 5/16-24 x 1-3/4 in.
- (2 rqr)
- 9 Rod cap
- 10 Nut, plain, hex, 5/16-24 (2 rqr)
- 11 Nut, stamped, 5/16-24 (2 rqr)
- 12 Shim
- 13 Sleeve bearing

Figure 40—Continued.

99. General

The piston is an aluminum-alloy, four-ring piston. The piston has two compression rings, a scraper ring, and an oil control ring. The piston pin is of hollow steel and is held in place with a retaining ring at each end. The connecting rod is fitted with a sleeve bearing for the piston pin. The fit of the connecting rod on the crankshaft is governed by shims between the connecting rod and rod cap. Heat-treated screws with special washers retain the rod and cap.

100. Piston and Connecting Rod

- a. Remove and install the cylinder head (par. 66).
- b. Remove and install the engine base and oil pump (par. 96).
- c. Remove and install the connecting rod and piston as shown by figure 37.
- d. Disassemble and reassemble the connecting rod and piston as shown by figure 40.
 - e. Clean, inspect, and repair.

Section VIII. CRANKSHAFT

101. General

The crankshaft is supported at both ends by cones and rollers. The outer race, or the cup of the bearing on the take off end of the engine, is supported in the bearing plate. Shims are installed between the bearing plate and the crankcase to provide the proper crankshaft end play. The bearing retainer plate is attached to the flywheel end of the engine crankcase.

102. Bearing Plate

- a. Remove and install the connecting rod and piston (par. 100).
- b. Remove and install the bearing plate as shown by figure 41.

103. Bearing Retainer Plate

- a. Remove and install the rope starting sheave (par. 64).
 - b. Remove and install the flywheel (par. 65).
- c. Remove and install the flywheel shroud (par. 50).
- d. Remove and install the bearing retainer plate as shown by figure 42.
 - e. Clean and inspect.

104. Crankshaft

- a. Remove and install the connecting rod and piston (par. 100).
- b. Remove, disassemble, reassemble, and install the crankshaft as shown by figure 43.
 - c. Clean, inspect, and repair.

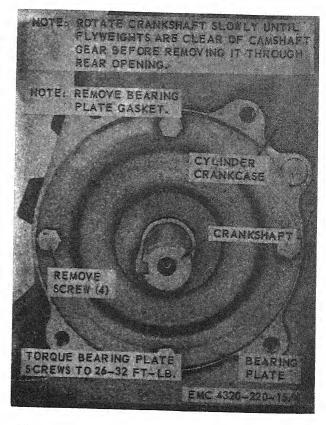


Figure 41. Bearing plate, removal and installation.



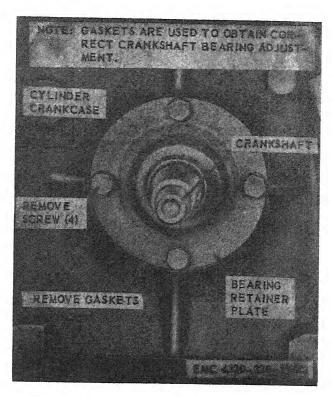
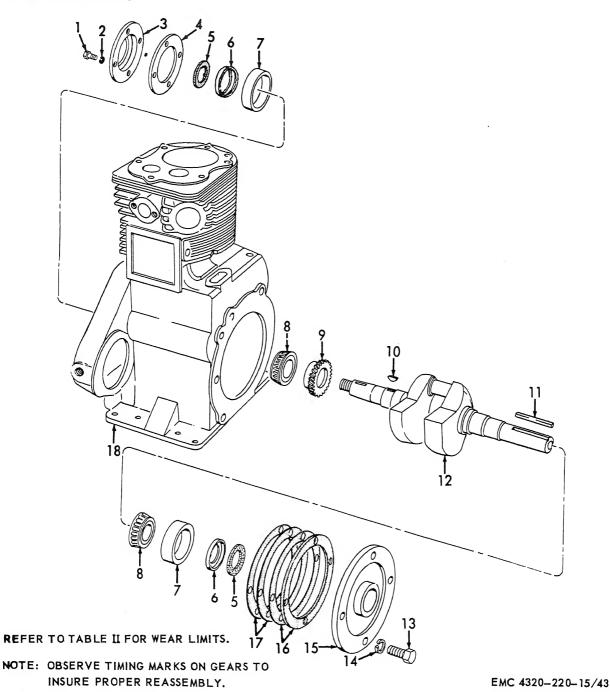


Figure 42. Bearing retainer plate removal and installation.



1 Bolt, machine, hex-hd, 5/16-18 x 3/4 in. (4 rqr)

2 Washer, lock, 5/16 in. (4 rqr)

3 Bearing retainer plate

4 Gasket

5 Oil seal retainer (2 rqr)

6 Gasket (2 rqr)

7 Roller bearing cup (2 rqr)

8 Cone and roller (2 rqr)

9 Crankshaft gear

- 10 Key, woodruff, No. 6
- 11 Key, machine, $1/4 \times 1/4 \times 2-1/2$ in.
- 12 Crankshaft
- 13 Screw, cap, hex-hd, $3/8-18 \times 1$ in.
- (4 rqr)
- 14 Washer, lock, 3/8 in. (4 rqr)
- 15 Bearing plate 16 Gasket, 0.003 in.
- 17 Gasket, 0.006 in.
- 18 Cylinder crankcase

Figure 43 Crankshaft, removal, disassembly, reassembly, and installation.



Section IX. GOVERNOR YOKE, CAMSHAFT ASSEMBLY AND LIFTERS, AND GOVERNOR FLYWEIGHT ASSEMBLY

105. General

The camshaft, an alloy-steel forging, rotates on a pin driven into the crankcase and actuates the oil pump push rod. The mushroom-type lifters open and close the intake and exhaust valves. The governor flyweights, assembled on the camshaft, control the engine speed by varying the throttle opening as required by the load imposed upon the engine. The governor yoke actuates the governor control lever which in turn actuates the carburetor linkage.

106. Governor Yoke, Camshaft Assembly and Governor Flyweight Assembly

- a. Remove and install the governor linkage (par. 58).
- b. Remove and install the crankshaft (par. 104).
- c. Remove, disassemble, reassemble, and install the governor yoke, camshaft assembly and lifters, and governor flyweight assembly as shown by figure 39.
 - d. Clean, inspect, and repair.

Section X. CYLINDER CRANKCASE

107. General

The cylinder crankcase is the main structural component of the complete engine. This one-piece casting houses such components as the engine oil pump, valves, Stellite valve seats, camshaft, and crankshaft. Other internal operating parts include an aluminum alloy piston and connecting rod, mushroom-type valve lifters, and centrifugal flyweight-type governor. Mounted to the cylinder crankcase are the cylinder head, engine base plate, a float-type carburetor, air cleaner, muffler, fuel tank and magneto.

108. Cylinder Crankcase

- a. Remove and install the carburetor (par. 56).
- d. Remove and install the rope starting sheave cover plate (par. 67).
- c. Remove and install the assembled fuel tank and bracket (par. 53).

- d. Remove and install the rope starting sheave (par. 64).
- e. Remove and install the flywheel (par. 65).
- f. Remove and install the oil fill plug and gage and oil drain plug (par. 55).
- g. Remove and install the governor control assembly and linkage (par. 58).
- h. Remove and install the crankcase breather line (par. 51).
 - i. Remove and install the magneto (par. 61).
- j. Remove and install the bearing plate (par. 102).
- k. Remove and install the bearing retainer plate (par. 103).
- l. Remove and install the intake and exhaust valves and related parts (par. 98).
- m. Remove and install the crankshaft (par. 104).
- n. Remove and install the governor yoke, camshaft assembly and lifters, and governor flyweight assembly (par. 106).
 - o. Clean and inspect.

APPENDIX I

REFERENCES

1. Dictionaries of Terms and Abbreviations

AR 320-5 Dictionary of United States Army Terms

AR 320-50 Authorized Abbreviations and Brevity Codes

2. Fire Protection

TM 5-687 Repairs and Utilities; Fire Protection Equipment and Appliances; Inspec-

tions, Operations, and Preventive Maintenance

TM 9-1799 Ordnance Maintenance: Fire Extinguishers

3. Lubrication

LO 5-4320-220-15 Pump, Centrifugal: Gasoline Driven; Base Mtd; 2 In; 166 Gpm, 25 Ft

Head (Barnes Model 10-MG) W/Wisconsin Engine Model MAENLD

4. Painting

TB ENG 60 Preservation and Painting of Serviceable Corps of Engineers Equipment

TM 9-2851 Painting Instructions for Field Use

5. Preventive Maintenance

AR 700–38 Unsatisfactory Equipment Report

AR 750-5 Maintenance Responsibilities and Shop Operations

TM 5-505 Maintenance of Engineer Equipment

6. Publication Indexes

DA Pam 108-1 Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings

DA Pam 310-1 Index of Administrative Publications

DA Pam 310-2 Index of Blank Forms

DA Pam 310-3 Index of Training Publications

DA Pam 310-4 Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubri-

cation Orders, and Modification Work Orders

DA Pam 310-5 Index of Graphic Training Aids and Devices

DA Pam 310-25 Index of Supply Manuals—Corps of Engineers

7. Shipment and Limited Storage

AR 743-505 Limited Storage of Engineers Mechanical Equipment

TM 9-200 General Packaging Instructions for Ordnance General Supplies

TM 38-230 Preservation, Packaging, and Packing of Military Supplies and Equipment

8. Supply Publications

SM 10-1-C4-1 Petroleum, Petroleum-Base Products, and Related Material

TM 4320-220-25P Organizational, Field and Depot Maintenance Repair Parts and Special

Tool Lists

Pump, Centrifugal: Gasoline Driven; Base Mtd; 2 In.; 166 Gpm, 25 Ft Head (Barnes Model 10-MG) Serial Number Range 1 Through 207,

FSN 4320-820-0700

9. Training Aids

FM 5-25	Explosives and Demolition
FM 21-5	Military Training
FM 21-6	Techniques of Military Instruction
FM 21-30	Military Symbols

APPENDIX II

MAINTENANCE ALLOCATION CHART

1. General

This Appendix contains a Maintenance Allocation Chart listing all maintenance and repair operations authorized for the various echelons.

2. Maintenance

Maintenance is any action taken to keep material in a serviceable condition or to restore it to serviceability when it is unserviceable. Maintenance of material includes the following:

- a. Service. To clean, to preserve, and to replenish fuel and lubricants.
- b. Adjust. To regulate periodically to prevent malfunction.
- c. Inspect. To verify serviceability and to detect incipient mechanical failure by scrutiny.
- d. Test. To verify serviceability and to detect incipient mechanical failure by use of special equipment such as gages, meters, and so on.
- e. Replace. To substitute serviceable assemblies, subassemblies, and parts for unserviceable components.
- f. Repair. To restore an item to serviceable condition through correction of a specific failure or unservicable condition. This function includes but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and straightening.
- g. Overhaul. To restore an item to complete-ly serviceable condition as prescribed by serviceability standards developed and published by heads of technical services. This is accomplished through employment of the technique of "Inspect and Repair Only as Necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the term during the overhaul process.

3. Explanation of Columns

a. Functional Group. The functional group is a numerical set up on a functional basis

The applicable functional grouping indexes are taken from the Corps of Engineers Functional Grouping Indexes, and appear on the Maintenance Allocation Chart in their correct numerical sequence. These indexes are normally set up according to their proximity to each other and their function.

b. Components and Related Operation. This column contains the functional index grouping heading, subgroup headings, and a brief description of the part starting with the noun name. It also designates the operation to be performed such as service, adjust, inspect, test, replace, repair, and overhaul.

c. Echelon Maintenance.

Column 1. First Echelon: First echelon maintenance is that maintenance performed by the user or operator of the equipment, such as servicing, cleaning, lubricating, and limited adjustments. It also includes removal and replacement of items to accomplish servicing and lubricating.

plish servicing and lubricating.
Column 2. Second Echelon: Second echelon maintenance is that maintenance performed by trained personnel provided for that purpose in the using organization, such as replacement of all items in column 2, limited parts fabrication from bulk material, adjustments, and repair of assemblies, components, and end items that can be accomplished without extensive disassembly.

Column 3. Third Echelon: Third echelon maintenance is that maintenance performed by specially trained units in direct support of the using organization, such

as replacement of all items in columns 2 and 3, repair assemblies, components, and end items, and fabricate parts from bulk material.

Column 4. Fourth Echelon: Fourth echelon maintenance is that maintenance performed by units organized as semi-fixed or permanent shops to serve lower echelon maintenance within a geographical area, such as replacement of items in columns 2, 3, and 4, repair end items, overhaul assemblies, components, and fabricate general use common hardware and parts.

Column 5. Fifth Echelon: Fifth echelon maintenance is that maintenance authorized to overhaul assemblies, components, end items and replacement of all parts in column 2, 3, 4, and 5.

d. Symbol "X". The symbol "X" placed in the appropriate column indicates the lowest echelon responsible for performing that particular maintenance operation, but does not necessarily indicate repair parts will be stocked at that level.

e. Remarks. The remark column is used to explain why maintenance, that would normally by done at a lower echelon, is moved to a higher echelon because of some peculiarity in the construction of the end item.

MAINTENANCE ALLOCATION CHART

Functional group	Components and related operation			lons itenar		5	Remarks
		1		3	-	3	
01 0100	ENGINE ASSEMBLY Engine Assembly, Gasoline	77					
	Service Inspect Test	X	x				Communication
	Replace		x				Compression
	RepairOverhaul			x	x		
0101	CRANKCASE, BLOCK, CYLINDER HEAD						
	Head, Cylinder		\mathbf{x}				
0100	Replace		A				
0102	CRANKSHAFT Bearing Assembly, Crankshaft Replace			x			
	Crankshaft Assembly Replace			x			
0103	FLYWHEEL ASSEMBLY Flywheel, Crankshaft						
***	Replace		X				
0104	PISTONS, CONNECTING RODS Piston, Internal Combustion Engine Rod Assembly, Connecting						
	Replace			X			
0105.1	RepairVALVES			^			
	Valve, Pin, Hollow and Insert Replace			x			
	Repair			X			
	Springs, Locks, and Rotators Replace			x			
0105.2	ROCKER ARMS, TAPPETS Lifter, Valve						
	Adjust	_	X	x		Ì	
	Replace			x			
0105.3	CAMSHAFTS						
0100.0	Camshaft Assembly						
	Replace			X			
0105.5			Ì				
	Gears, Helical Timing: Crankshaft and						
	Camshaft Replace			\mathbf{x}			
0106.1	OIL PUMP			1			
	Body Assembly		1				
	Replace		-	. X			
	Repair			X			
	Plunger, Oil Pump Replace			x			
	Strainer, Oil Rump Service			x			Clean

Functional group	Components and related operation			elons ntenar	of		T			
	- Position	1	2	3	4	5	1	Remarks		
0106.5	CRANKCASE VENTILATION Line Assembly, Air Breather Replace			***						
0106.6	OIL PAN, LINES, LEVEL GAGE Plug, Pipe: W/Gage Replace			X				Fabricate		
0108	MANIFOLDS Manifold, Intake			X						
0111.1	ReplaceHAND CRANKING DEVICES Rope Assembly, Starting			X						
0.0	Replace	.	X							
03 0301	FUEL SYSTEM CARBURETOR; FUEL INJECTOR Carburetor, Float: Adjust Service			X X				Clean and Install Bowl Gas		
0304	ReplaceAIR CLEANER Air Cleaner, Intake			X				osom and instan bowl Gaz		
0306	ServiceTANKS, LINES, FITTINGS Tank Assembly, Fuel		X							
	Service Tube, Fuel Replace	1 1	X	x						
	Strainer, Fuel Tank Service			x				Fabricate Clean Screen		
0308	ReplaceENGINE SPEED GOVERNOR Yoke, Governor			X						
	Replace Flyweight Assembly Replace				x x					
0308.4	GOVERNOR CONTROLS Control Assembly Replace				A					
0309	RepairFUEL FILTERS			X X						
	Strainer Assembly Service Replace		x	 X				Install Bowl and Gasket		
0312	ACCELERATOR, THROTTLE OR CHOKE CONTROLS Rod, Throttle Lever									
	Replace			x						
0401	EXHAUST SYSTEM MUFFLER AND PIPES Muffler, Exhaust Replace									
0502 C	OOLING SYSTEM COWLING, DEFLECTORS, AIR DUCT, SHROUD			X						
	Shroud, Flywheel Service		\mathbf{x}					Clean Screen		

Functional	Components and related operation			elons (ntenan			Remarks			
group	Components and related operation	1	2	3	4	5				
	ELECTRICAL SYSTEM (ENGINE AND VEHIČULAR)									
0604.2	MAGNETO Magneto, Ignition									
	Adjust Replace			X						
	Repair			X			Install Kit			
	Capacitor and Contact Replace			x						
	Gear, Magneto Drive Replace			x						
0604.2	IGNITION COIL: WIRING, SPARK PLUGS									
	Cable Assembly, Spark Plug Replace			x						
	Spark Plug Service			\mathbf{x}						
	Adjust			X						
L 5	ReplaceFRAME			A						
1501.1	PLATFORMS, SUPERSTRUCTURES, RAMPS, CATWALKS Rails Base: Right and Left			x						
22	Replace MISCELLANEOUS BODY, CHASSIS			A						
2210	OR HULL, AND ACCESSORY ITEMS DATA PLATES AND INSTRUCTION HOLDERS									
	Plate, Identification (C.O.E.) Replace	-			x					
	Plate, Data and Instruction Replace	-		x					*	
55 5500	PUMPS (EXCLUDE ENGINE PUMPS) PUMP ASSEMBLY Pump, Centrifugal									
	InspectService	l l	X	1						
	ReplaceRepair	-		X X				•	•	
5501	VOLUTE, HOUSING Body, Pump Replace			x					•	
5502	IMPELLER, PUMP, CENTRIFUGAL ROTOR, DIAPHRAGM Seal, Shaft, Assembly	_								
	Replace	-		x						
5504	DISCHARGE ASSEMBLY Adapter, Pipe to Hose Replace			_x						
5504.2	SUCTION VALVE, SUCTION HEAD Valve, Lift Check	-		A						
	Replace	- 1		X						

Functional group	Components and related operation			helon	Remarks		
		1	2	8	4	5	Remarks
5504.2	PRIMING DEVICES Plug, Pipe						
5505	ReplaceLUBRICATORS		X				
	Cup, Grease Service Replace		x				
7603	IRE FIGHTING EQUIPMENT FIRE EXTINGUISHERS			X			
	Replace					\mathbf{x}	

APPENDIX III

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. General

Section II lists the accessories, tools, and publications required in 1st echelon maintenance and operation, initially issued with, or authorized for the centrifugal pump.

2. Explanation of Columns

- a. Source Codes. The information provided in each column is as follows:
 - (1) Technical Services. The basic number of the Technical Service assigned supply responsibility for the item is shown. Those spaces with no number shown are Corps of Engineers supply responsibility. Other Technical Service basic numbers are:
 - 10—Quartermaster Corps 12—Adjutant-General's Corps
 - (2) Source. The selection status and method of supply are indicated by the following code symbols:
 - (a) P—applied to repair parts which are high mortality parts; procured by technical services, stocked in and supplied from the technical service depot system; and authorized for use at indicated maintenance echelons.
 - (b) P1—applied to repair parts which are low mortality parts; procured by technical services, stocked only in and supplied from technical service key depots, and authorized for installation at indicated maintenance echelons.

- (3) Maintenance. The lowest maintenance echelon authorized to use, stock, install or manufacture the part is indicated the following code symbol:
 - Q—Organizational Maintenance (1st and 2d Echelons)
- b. Federal Stock Numbers. When a Federal stock number is available for a part, it will be shown in this column, and used for requisitioning purposes.
 - c. Description.
 - (1) The item name and a brief description of the part are shown.
 - (2) A five-digit Federal supply code for manufacturers and/or other technical services is shown in parentheses followed by the manufacturer's part number. This number will be used for requisitioning purposes when no Federal stock number is indicated in the Federal stock number Column.

Example: (0864586453.)

- (3) The letters GE, shown in parentheses immediately following the description, indicate General Engineer supply responsibility for the part.
- d. Unit of Issue. Where no abbreviation is shown in this column, the unit of issue is "each".
- e. Expendability. Those items classified as nonexpendable are indicated by letters "NX". Items not indicated by "NX" are expendable.
- f. Quantity Authorized. This column lists the quantities of repair parts, accessories, tools, or publications authorized for issue to the equipment operator or crew as required.

- g. Quantity Issued with Equipment. This column lists the quantities of repair parts, accessories, tools, or publications that are initially issued with each items of equipment. Those indicated by an asterisk are to be requisitioned through normal supply channels as required.
- h. Illustrations. This column is subdivided into two columns which provide the following information:
 - (1) Figure number. Provides the identifying number of the illustration.
 - (2) Item number. Provides the referenced number for the part shown in the illustration.

3. Index to Federal Supply Code for Manufacturers

66289 _____ Wisconsin Motor Corps.

4. Comments and Suggestions

Suggestion and recommendations for changes to the Basic Issue Items List will be submitted on DA Form 2028 to The Commanding General, U. S. Army Engineer Maintenance Center, Corps of Engineers, ATTN: EMCM, P. O. Box 119, Columbus 16 Ohio. Direct communication is authorized.

APPENDIX III Section II BASIC ISSUE ITEMS LIST

S	ource	B CO	des							
Technical service Source Maintenance Recoverability		Maintenance Recoverability		Federal stock no.	Description	Unit of issue	Expendability	Quantity authorized	Quantity issued with equipment	 item
	P	0		2990-618-6556	GROUP 01 ENGINE 011.1.1 HAND CRANKING DEVICES STARTER ROPE, ENGINE, (66289) U-268 (GE) (Can be manufactured from CORD, SASH, stock No. 4020-241-8439 3 ft) GROUP 26 ACCESSORIES, PUBLICA- TIONS, TEST EQUIPMENT AND TOOLS 2602.1 ACCESSORIES			1	1	
10	P	0		7520-559-9618	CASE, MAINTENANCE AND OPERATIONAL MANUAL: cotton duck, water repellent, mildew resistant 2602.2 COMMON TOOLS			1	1.	
10	P	0		5120-264-3796	WRENCH, OPEN END, ADJUSTABLE: single head 0 to 1-5/16 in. jaw opening, 12 in. lg			1	(*)	
	P	0		5120-293-1602	WRENCH, SPANNER: 2602.4 PUBLICATIONS			1	(*)	
12					DEPARTMENT OF THE ARMY OPERATOR, ORGANIZATIONAL, FIELD AND DEPOT MAINTENANCE MANUAL TM 5-4320-220-15			2	2	
12					DEPARTMENT OF THE ARMY LUBRICATION ORDER LO 5-4320-220-15 GROUP 76 FIRE FIGHTING EQUIPMENT 7603 FIRE EXTINGUISHERS			1	1	
	Pi	1 0			EXTINGUISHER, FIRE, VAPORIZING LIQUID: 1/4 gal capacity, w/wall bracket (GE)			(Sec	Note)	
	P	1 0		4210-555-8837	EXTINGUISHER, FIRE, MONOBROMO- TRIFLUOROMETHANE: charged, hand shatterable cylinder, penetrating seal valve, stored pressure, w/bracket 2.751b (HALON 1301) MIL-SPEC E52031 (GE) Note. Requisition CTC/CO ₂ extinguisher until depot stocks are exhausted.			1	1	

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For explanation of abbreviations used, see AR 320-50.

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